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EDITOR OF THE MONTH

FRED B. MOOR, M.D.

Los Angeles, Calif.

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POSTGRADUATE COURSE IN PHYSICAL MEDICINE AND REHABILITATION

UNIVERSITY OF TEXAS, MEDICAL BRANCH, GALVESTON

MARCH 1-5, 1948

TENTATIVE PROGRAM

Monday, March 1st —

8:00	Registration	
9:00	Opening Remarks	Selle and Leake
9:15	Clinical Application of Physics and Physiology in Physical Medicine	White
9:45	The Relation of Physical Medicine to Other Fields of Medicine	Boynton
10:05	Recess	
10:15	Present Status of Fever Therapy	Kendell
10:45	Assistive and Supportive Apparatus in the Treatment of Muscle and Nerve Injuries	Bennett
11:15	Work of the Council on Physical Medicine	Jung
11:45	Question Period	

Afternoon Session

1:30	Instructional Period: Medical Diathermy	Osborne
2:15	Heating Effects of Microwaves	Worden
2:45	Question Period and Recess	
3:00	Progress in Ultraviolet and Infrared Therapy	Kovács
3:45	Dynamic Aspects of Physical Medicine in the Veterans Administration	Knudson
4:15	Question Period	
4:25	War Department Sound Motion Picture	

Tuesday, March 2nd —

8:15	Instructional Period: Physiological Basis of Therapeutic Exercise	Worden
9:00	Physiology of Normal and Atrophic Muscles and Its Application to Clinical Medicine	Tate
9:30	Dynamic Physical Reconditioning	Quinn
10:00	Question Period	
10:15	Aspects of the Backache Problem	Jostes
11:00	Occupational Therapy	Kendell
11:45	Question Period	

Afternoon Session

1:30	Instructional Period: Principles of Muscle Testing and Muscle Reeducation	Bennett
2:15	Electrical Stimulation of Muscles	Osborne
2:45	Question Period and Recess	
3:00	Bulbar Cases of Poliomyelitis	Grulee
3:30	Physical Medicine in Nerve Injuries	Rose
4:00	Unsolved Problems in Physical Medicine	Jung
4:30	Question Period	

Evening — Hotel Galvez Entertainment

Wednesday, March 3rd —

8:15	Instructional Period: Essentials of Hydrotherapy	Selke
9:00	Clinical Application and Significance of Electromyography	Rose

9:30 An Ideal Treatment Program for Poliomyelitis.....Bennett
10:30 Question Period and Recess
10:45 Uses of Ion Transfer.....Kovács
11:15 Functional Anatomy of the Hip Joint.....Duncan
11:45 Question Period

Afternoon Session

1:30 Instructional Period: Physical Medicine in Fractures.....Jostes
2:00 Physical Medicine for Medical and Surgical Conditions of the Chest.....Kuitert
2:45 Question Period and Recess
3:00 The Role of Physical Medicine in Arthritis.....Krusen
3:45 Biophysics in the Medical Curriculum.....Jung
4:15 Status of Physical Therapists.....Mildred Elson

Evening Meeting — Galvez Hotel

American Spas and Scenic Splendors.....Kovács
Movies
Social Hour

Thursday, March 4 —

8:15 Instructional Period: Electrodiagnosis.....Speaker to Be Announced
9:00 Physical Medicine in General Surgery.....Theil
9:30 The Contact Splint.....Eggers
10:00 Physical Medicine in Orthopedic Surgery.....Jostes
10:30 Question Period and Recess
10:45 Physical Medicine in Ophthalmology.....Daily
11:15 Subject and Speaker to Be Announced
11:45 Question Period

Afternoon Session

1:30 Instructional: Minor Electrosurgery.....Speaker to Be Announced
2:00 Physical Medicine in Peripheral Vascular Diseases.....Rose
2:30 Physical Medicine in Psychiatry.....Ewalt
3:00 Question Period and Recess
3:15 Physical Medicine in the Army.....Kuitert
3:45 Physical Medicine in General Practice.....Kendell
4:15 Physical Medicine in Institutional Practice.....Kovács
4:30 Question Period

Thursday Night — Galvez — Annual Dinner

Chauncey Leake, Presiding

Physical Medicine Yesterday, Today and Tomorrow.....Krusen

Friday, March 5 —

8:15 Low Frequency High Resistive Exercises.....Kuitert and Miss Decker
9:00 Rehabilitation of Spinal Cord Injuries with Live Demonstrations.....Covalt
10:30 Question Period and Recess
10:45 Rehabilitation in Industrial Medicine.....Osborne
11:15 Rehabilitation in Civilian Hospitals.....Krusen

Afternoon

The Department of Physical Medicine, University of Texas, Miss Ruby Decker, Technical Director, will be open for inspection.

For enrollment blanks and further information address: W. A. Selle, Director of Postgraduate Course in Physical Medicine, University of Texas, Galveston, Texas.

APPROVED SCHOOLS FOR PHYSICAL THERAPY TECHNICIANS ‡

Council on Medical Education and Hospitals of the American Medical Association

Name and Location of School	Medical Director Technical Director	College Affiliation	Entrance Requirements *	Duration of Course	Time of Admission	Maximum Enrollment	Tuition	Certificate, Diploma, Degree
Children's Hospital, Los Angeles[1]	Samuel Mathews, M.D. Miss Sarah Rogers	Univ. Calif. at Los Angeles	a-b-c	14 mos.	Sept	14	$200	Diploma
College of Medical Evangelists, Los Angeles[1]	Fred B. Moor, M.D. A. H. Carlson	School of Medicine Coll. Med. Evangelists	a-b-c-d	12 mos.	Sept	20	$225	Cert. or Dipl.
University of California Medical School, San Francisco[1]	Frances Baker, M.D. Mrs. Margery L. Wagner	Univ. Calif.	d-e	12 mos.	Sept.	12	$220[2]	Cert. or Degree
Stanford University, Stanford University, Calif.[1]	W. H. Northway, M.D. Miss Lucille Daniels	Stanford Univ.	a-b-d	10 mos.	Quarterly	16	$409	Cert. or Degree
Northwestern University Medical School, Chicago	John S. Coulter, M.D. Miss Gertrude Beard	Northwestern Univ.	a-b-d	12 mos.	JulyOct	16	$300	Certificate
State University of Iowa Medical School, Iowa City	W. D. Paul, M.D. Miss Olive C. Farr	State Univ. Iowa	f	12 mos.	Sept	....	$200	**
University of Kansas School of Medicine, Kansas City[1]	Donald L. Rose, M.D. Mrs. Ruth G. Monteith Miss Lilyan G. Warner	Univ. Kans.	a-b-c[2]	12 mos.	FebSept	20	$ 80[2]	Cert. or Degree
Bouvé-Boston School of Physical Education, Boston	Arthur L. Watkins, M.D. Miss Constance K. Greene	Tufts Coll.	c[4]	10 mos.	Sept	15	$250[5]	Cert. or Degree
Boston University, College of Physical Education for Women, Sargent College, Cambridge, Mass.	Kenneth Christophe, M.D. Miss Adelaide L. McGarrett	Boston Univ. Med. Sch.	H.S.	4 yrs.	Sept	20	Varies	Cert. or Degree
University of Minnesota, Minneapolis[1]	M. E. Knapp, M.D. Miss Ruby Green	Univ. Minn.	H.S.	4 yrs.	Oct	12	$530[6]	Degree
Barnes Hospital, St. Louis	F. H. Ewerhardt, M.D. Miss Beatrice F. Schulz	Wash. Univ. Sch. Med.	a-b-c	12 mos.	Oct	12	$200	Certificate
St. Louis University School of Nursing, St. Louis[3]	A. J. Kotkis, M.D. Sister Mary Imelda	St. Louis Univ.	a[2]	10 mos.	Jan-Sept	12	$250 yr.	Cert. or Degree
Columbia University, College of Physicians and Surgeons, New York City[1]	William B. Snow, M.D. Miss Josephine L. Rathbone	Columbia Univ.	a-c[6]	2 yrs.	Sept	35	$400 yr.	Cert. or Degree
New York University School of Education New York City[1]	George G. Deaver, M.D. Miss Elizabeth C. Addoms	New York Univ.	a-b-d	12 mos.	Sept	40	$525	Cert. & Degree
Duke Hospital, Durham, N. C.[1]	Lenox D. Baker, M.D. Miss Helen Kaiser	Duke Univ.	a-b-d	15 mos.	Oct	12	$300	Certificate
D. T. Watson School of Physiotherapy, Leetsdale, Pa.[1]	Jessie Wright, M.D. Miss Kathryn Kelley	Univ. Pittsburgh	a-b-d	12 mos.	Oct	30	$200	Dipl. or Degree
Graduate Hosp. of the Univ. of Pennsylvania, Phila.[1]	G. M. Piersol, M.D. Miss Dorothy Baethke	Univ. Penna.	a-b-c	12 mos.	Sept	20	$200	Certificate
University of Texas School of Medicine, Galveston[1]	G. W. N. Eggers, M.D. Miss Ruby Decker	Univ. Texas	a-b-d[8]	12 mos.[7]	Jan	6	$141[8]	Certificate
Baruch Center of Physical Medicine of the Medical College of Virginia, Richmond, in affiliation with Richmond Professional Institute[1]	F. A. Hellebrandt, M.D. Edith M. Vail, B.S.	Med. Coll. Virginia	a-b-c[2]	12 mos.†	Sept	20	$200[5]	Cert. or Degree
University of Wisconsin Medical School, Madison[1]	Harry D. Bouman, M.D. Miss Margaret A. Kohli	Univ. Wis.	a-b-c[2]	12 mos.	Sept	20	$ 96[2]	Cert. or Degree
University Southern California, Los Angeles	O. L. Huddleston, M.D. Charlotte Anderson	Univ. of S. Calif	d[2]	12 mos.	Sept	16	$374	Certificate
Albany Hospital, Albany, N. Y.	John Ghormley, M. D. Catharine Graham	None	a-b-c	12 mos.	Sept	6	$200	Certificate
Mayo Clinic Section on Physical Medicine, Rochester, Minnesota	Frank H. Krusen, M.D. Miss Ruth Ryan	None	a-b-c	12 mos.	July	20	none	Certificate
Children's, Massachusetts General, Peter Bent Brigham Hospitals	William T. Green, M.D. Arthur L. Watkins, M.D. Miss Janet B. Merrill	School of Science Simmons College	a[9]-b[9]-d-e[10]	16 mos.	Sept	25	$550	Diploma or Diploma and Degree[10]
University of Colorado Medical Center, Denver, Colorado[2]	Harold Dinken, M.D. Miss Mary Lawrence	University of Colorado Medical Center	a-b-d	12 mos.	JanSept	Varies	$300[2]	Certificate

* Courses are so arranged that any of the entrance requirements will qualify students for training. a = Graduation from accredited school of nursing; b = Graduation from accredited school of physical education; c = Two years of college with science courses; d = Three years of college with science courses; e = Four years of College with science courses; H. S. = High school graduation; f = degree in physical education or sciences.

† Currently eighteen Navy nurses are enrolled in a six-month emergency course.

1. Male students admitted.
2. High school graduates admitted to four-year course leading to degree.
3. Non-residents charged additional fee.
4. High school graduates admitted to four-year course leading to degrees from Tufts College.
5. Tuition for degree course is $400 per year.
6. College graduates admitted to twelve month certificate course.
7. Effective 1947 class.
8. Effective 1948 class.
9. With adequate science courses.
10. High school graduates admitted to four and one-half years course leading to degree from Simmons College.

‡ Reprinted in part J. A. M. A. 133:1140 (April 12) 1947.

** At the end of nine months the students can register in the graduate school for a degree of master of science in Physical Therapy.

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APPROVED SCHOOLS FOR OCCUPATIONAL THERAPY TECHNICIANS *

Council on Medical Education and Hospitals of the American Medical Association

NOTE: The duration of the course is expressed in academic years and in most schools the accelerated curriculum is being followed.

Name and Location of School	College Affiliation	Duration of Course	Classes Start	Entrance Requirements	Tuition Per Year	Certificate, Diploma, Degree	Graduates in 1945
University of Southern California, 3551 University Ave., Los Angeles	University of Southern California	2 yrs. 5 yrs.	Sept FebSept	Degree High sch.	$330 $330	Certificate Cert.&B.S.	8
Mills College, Oakland, Calif.	Mills College	3 yrs. 5 yrs.	FebSept FebSept	Degree High sch.	$200 $450	Certificate Cert.&Deg.	4
San Jose State College, San Jose, Calif.	San Jose State College	3 yrs. 5 yrs.	JanOct Varies	1 yr. coll. High sch.	$ 21 $ 21	Certificate Degree	1
University of Illinois College of Medicine, 1853 W. Polk St., Chicago	University of Illinois	4½ yrs.	Varies	High sch.	$ 80	B.S.	None
University of Kansas, Lawrence	University of Kansas	2 yrs. 4 yrs.	FebSept FebSept	Degree High sch.	$ 50 $ 50	Certificate B.S.	1
Boston School of Occupational Therapy, 7 Harcourt St., Boston	Tufts College	2 yrs. 3 yrs. 5 yrs.	Sept JulySept Sept	Degree 1 yr. coll. High sch.	$400 $400 $400	Diploma Diploma Dipl.&B.S.	41
Kalamazoo School of Occupational Therapy, Western Michigan College of Education, Kalamazoo	Western Michigan College of Education	2 yrs. 4 yrs.	July FebSept	Degree 1 yr. coll.	$ 51 $ 95	Certificate Cert.&Deg.	20
Michigan State Normal College, Ypsilanti	Michigan State Normal College and Univ. of Michigan	5 yrs.	Varies	High sch.	$ 67	Cert.&Deg.	8
St. Louis School of Occupational and Recreational Therapy, 4567 Scott Ave., St. Louis	Washington University	3 yrs.	Sept	2 yrs. coll.	$350	B.S.	13
University of New Hampshire, Durham	Univ. of New Hampshire	5 yrs.	Sept	High sch.	$160	Cert.&Deg.	5
Columbia University College of Physicians and Surgeons, 630 W. 168th St., New York City	Columbia University	2 yrs. 3 yrs.	Sept Sept	Degree 2 yrs. coll.	$450 $450	Certificate B.S.	18
New York University School of Education, 100 Washington Sq. E., New York City	New York University	4½ yrs.	Quarterly	High sch.	$450	Cert.&Deg.	13
Ohio State University, Columbus	Ohio State University	4½ yrs.	Quarterly	High sch.	$ 80	B.S.	11
Philadelphia School of Occupational Therapy, 419 S. 19th St., Philadelphia	University of Pennsylvania	2 yrs. 3 yrs. 5 yrs.	Sept Sept Varies	Degree 1 yr. coll. High sch.	$400 $400 $400	Diploma Diploma Dipl.&B.S.	45
Richmond Professional Institute, 901 W. Franklin St., Richmond, Va.	College of William and Mary	2½ yrs. 3 yrs.	Sept Sept	Degree 1 yr. coll.	$200 $200	Certificate Diploma	4
Milwaukee-Downer College, Dept. of Occupational Therapy, 2512 E. Hartford, Milwaukee	Milwaukee-Downer College	3 yrs. 5 yrs.	Sept Sept	1 yr. coll. High sch.	$250 $250	Diploma Dipl.&B.S.	15
Mount Mary College, 2900 Menomonee River Dr., Milwaukee	Mount Mary College	5 yrs.	Sept	High sch.	$210	B.S.	7
University of Toronto, Dept. of University Extension, Toronto, Ont., Canada	University of Toronto	3 yrs.	Sept	1 yr. coll.	$175	Diploma	40

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A STUDY OF THE KINEMATICS AND DYNAMICS OF THE HUMAN GAIT AND ITS APPLICATION IN POLIOMYELITIS *

Preliminary Report

IRVING REHMAN, Ph.D.

Assistant Professor of Anatomy and of Physical Medicine, University of Southern California School of Medicine

LOS ANGELES

The Kinematics and Dynamics of the Human Gait

Clinical observations have emphasized the need for functional studies and critical objective evaluation of muscle and joint actions in the normal and the pathologic conditions. Anatomic studies on cadavers, although detailed and accurate, still fall considerably short of adequately explaining a number of muscle and joint actions that patients have been taught to perform when the normal mechanism has been impaired. Accurate and extensive manual and electric clinical tests on patients designed to evaluate the condition of their neuromuscular pathways and muscular and joint system in the performance of a given motion may result in the conclusion that the particular function concerned, such as flexion, extension or rotation, cannot theoretically be performed owing to the extensive nature of the involvement. Yet the patient defies the classic concepts of anatomy and performs these functions. It becomes evident, therefore, that a more functional approach to the action of the neuromuscular and skeletal systems is necessary.

A research program designed to study functional human anatomy in both normal and pathologic conditions had been undertaken approximately two years ago at the University of Southern California. The present preliminary report concerns itself primarily with the development of the procedures and equipment; procedures such as the evolution of a method of visualizing muscle action in situ in the living state, the high speed x-ray motion picture technic and equipment, the development of a gait machine and force plate for recording the stresses, strains and torques developed in the normal gait and the correlation of electric and manual muscle and nerve testing with objective recording of normal and pathologic gaits.

Preliminary investigations were carried out in small animals in an effort to develop a means of visualizing and recording muscle and joint actions. Short blunted tantalum or stainless steel pins were inserted through a 23 gage hypodermic needle and implanted at right angles to each other in the gastrocnemius muscle of the rat.

Periodic roentgen examination of the extremities containing pin implants showed that the pins tended to remain in situ and did not migrate or shift for approximately four months.

The method of orientation of the pins may be seen in figure 1. The tibiocalcaneal angle was used as an index of contraction or relaxation of the gastrocnemius muscle into which the pins were implanted. Accurate meas-

* Read at the Twenty-Fourth Annual Session of the American Congress of Physical Medicine, New York, Sept. 5, 1946.

* We wish gratefully to acknowledge the assistance of the Committee on Prosthetic Devices of the National Academy of Sciences, the Baruch Committee on Physical Medicine, the General Electric X-ray Corporation for the loan of x-ray equipment, and the invaluable assistance of M. Fishbein, and G. Motis of the Northrop Aircraft, Incorporated.

urements of the lengths of the pin were made previous to implantation and the roentgenograms of these pins in situ again measured with the muscle in the contracted and in the relaxed states. The degrees of rotation of the

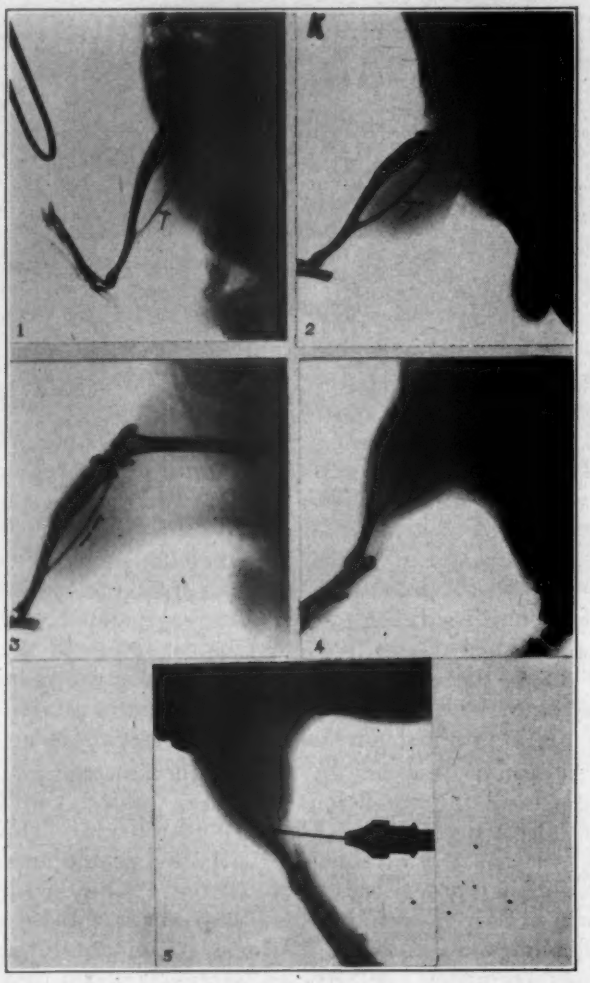

PLATE I

Fig. 1. — Stainless steel muscle orientation pins inserted into rat gastrocnemius muscles at right angle to each other. Muscle in the relaxed state.

Fig. 2. — Active contraction of gastrocnemius muscle producing slight separation of pins and rotation of transverse pin.

Fig. 3. — Reorientation of transverse pin into longitudinal axis of muscle four months after insertion.

Fig. 4. — Separation of pins during contraction of gastroenemius, sciatic nerve stimulation.

Fig. 5. — Direct muscle stimulation. Separation of pins and rotation of transverse pin may be seen.

pins were determined by the apparent foreshortening or displacement of the pins. Histologic examination of the tissues in which the stainless steel and tantalum pins were embedded failed to show signs of any inflammation or foreign body reaction. No noticeable effect could be observed upon the gait of the animals having the pin implants. These studies were carried out on a series of 76 animals for a period of nine months, with no untoward results; hence it seems safe to attempt this procedure in the human subject. Several volunteers, both normal persons and persons with varying degrees

of involvement of the joints and musculature of the lower extremity, will be tested.

Several interesting and unexpected phenomena have been encountered in these preliminary animal studies. Active contraction of the rat gastrocnemius muscle was induced by galvanic and faradic stimulation of the sciatic nerve. Varying degrees of separation and also of rotation of the transverse pin were observed (fig. 2). The extent of muscle contraction was determined by the change in the tibiocalcaneal angle. The rotational shift of the transverse pin may be either due to unequal contraction of the muscle fibers in one muscle belly of the rat gastrocnemius muscle or possibly due to a torque or rotational type of contraction or shortening. The separation of the pins on contraction of the muscle belly was contrary to expectations. The possibility that the pins had been inserted into two separate muscles was ruled out by postmortem examination.

It was found, however, that after a period of approximately four months the pin that had been implanted in a transverse axis to the muscle belly gradually rotated so that it finally became oriented parallel to the long axis of the muscle belly and to the longitudinal pin (fig. 3). The distance between the pins had undergone no appreciable change.

Studies carried out upon these animals several months after the implant produced results similar to those in the animals with recent pin implants. Stimulation of the sciatic nerve resulted in contraction of the gastrocnemius muscle but with separation of the pins and rotation of the transverse pin (fig. 4). Upon relaxation of the muscle, the pins again approximated each other; the transverse pin returned to its original position.

Direct muscle stimulation by means of needle electrodes as well as passive flexion and extension of the lower extremity were carried out, and the results were similar to those enumerated (fig. 5).

These preliminary animal studies indicate the advisability of carrying on further pin implant studies upon animals as well as healthy human subjects and patients with poliomyelitis.

This technic of functional muscle analysis has been combined with the study of joint action in another phase of the project in an attempt to arrive at a better understanding of joint action in the normal human gait. Anthropologic measurements of a series of healthy subjects were made for purposes of correlation of the type of gait, the body build, the lengths of the various components of the lower extremities with the muscle and joint action and with the forces and torques exerted with the changes in gait resulting from shifts in the center of gravity and with the gravitational pulls resulting from varying loading conditions, etc. Measurements of the lengths and diameters of the bones and the angles subtended by the joints under varying conditions were made in order to construct the necessary force diagrams and calculate the components and resultant forces.

In correlation with the force plate studies x-ray motion pictures are taken. These afford another means of joint action study as well as give data for force interpretations.

The equipment necessary to obtain these data is as follows: A long narrow platform, approximately 40 feet long, has an upright grid screen, 7 feet high and 15 feet long placed alongside. As the subject steps onto the walk, a light beam is interrupted. This starts a camera taking motion pictures (at 60 exposures per second) of the subject walking along the platform. These pictures help to determine the rate and type of gait, the distance that the various portions of the lower extremity are elevated from the platform and the angular changes in the positions of the joints. The excursions of the various bony landmarks are also obtained by means of markings over these points.

When the subject reaches the end of the grid screen he interrupts another light beam that automatically turns off the camera scanning the grid screen and initiates the operation of another camera, an x-ray tube and a carriage to convey this camera and x-ray tube as well as a fluoroscopic screen. The carriage is propelled in such a manner as to maintain the x-ray beam centered upon a specific portion of the walking subject (fig. 6). The x-ray exposure is kept to a minimum, so that several tests of the same subject may be safely made.

The possibility of using one of several existing methods of cineradiography as used by Janker,[1] Reynolds,[2] Stewart[3] and Barclay[4] were explored but eventually ruled out either because of the large and cumbersome size of the equipment or the extremely high radiologic dose to the subject or the electric and mechanical difficulties that would be encountered in attempting to take high speed x-ray motion pictures. A satisfactory method based upon the synchronization of the camera with the x-ray pulse was developed by us, so that x-ray motion pictures could be taken at 60 frames per second, the subject given a relatively small radiation dose and the entire equipment mounted on a movable carriage. A force plate has been inserted in the floor of the platform so that a number of measurements of the forces, torques, side and longitudinal loads, stresses and strains may be obtained simultaneously with the x-ray motion picture. These are correlated with the x-ray motion picture in order to determine the part taken by the various components of the lower extremity during the normal gait. The various steps in this procedure are all automatically controlled by light beams (fig. 7).

The force plate inserted in the floor of the walk consists of a number of strain gages and torque tubes designed to feed in and record their loads on a multiple channel oscillograph. The arrangement of the elements of the force plate and the forces they are designed to measure are as follows: The vertical force loads are recorded by means of three sets of strain gages. Gages 1 and 2 record the vertical loads as the heel comes down on the plate. Gage 4 records the full load of the subject at the toes immediately previous to shifting the weight to the opposite foot. The sum of the forces exerted upon gages 1, 2 and 4 equals the total force of the body. This will vary under differing conditions, as will be seen presently. The rotational or torque forces are recorded by gages numbered 3 and 8. The anterior (fore) and posterior (aft) or longitudinal loads are taken care of by gage 6 and the lateral or side loads by gage 5. The simultaneous recording of these gages upon the oscillograph tape made it possible to correlate and time each phase of the gait and its normal duration and compare these forces with the positions of the bony and muscular components as seen in the x-ray motion pictures. The duration of time during which the foot remained on the force plate in normal walking was found to be between 0.7 and 0.8 second. These preliminary observations agreed with those of Fischer,[5] Steindler,[6] and Elftman.[7]

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The following oscillographic recordings show the sequence of application of the stresses and strains. In the normal step the application of the forces at points 1 and 2 can be seen as the heel comes down on the plate (fig. 8). The force is gradually removed from the heel and passes forward

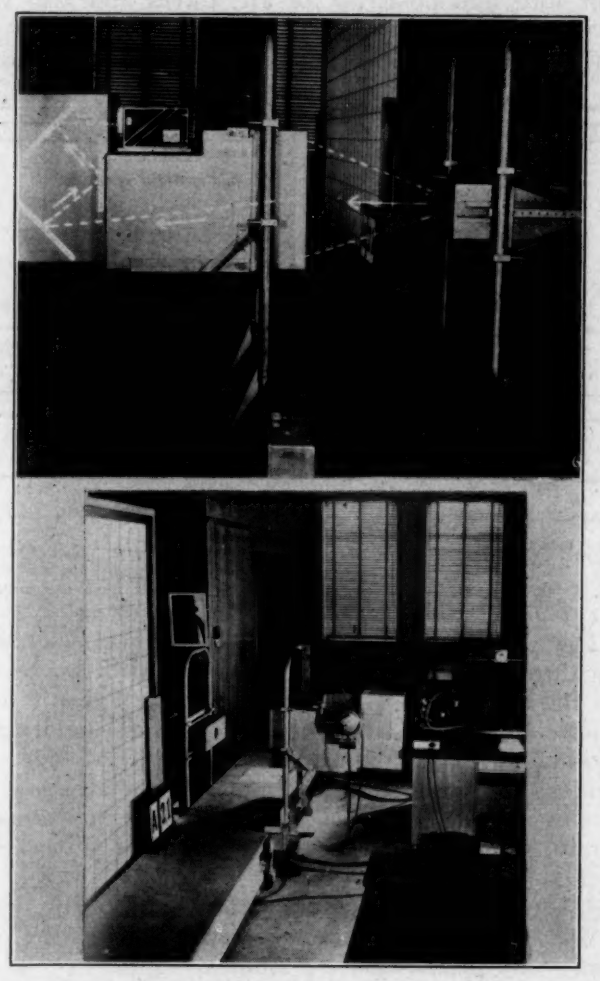


PLATE II

Fig. 6. — X-ray tube, fluorescopic screen and camera mounted on movable carriage. Subject walking through is centered in the path of the x-ray beam.

Fig. 7. — Detail of x-ray photographic apparatus showing position of photo cell light beams adjacent to A21 automatically controlling the x-ray apparatus and camera.

through the medial and lateral longitudinal arches to the metatarsal arch, which at this point carries the total weight. The longitudinal forces are applied in a foreward, or anterior direction as the heel comes down, but this changes to posterior, or aft direction as the center of gravity moves forward. A slight degree of side loading due to muscular contraction can be seen.

In the step in which slight hesitation occurs, similar total displacements are recorded, although the duration is somewhat longer (fig. 9).

In the step having a longer period of hesitation, the application of the force is distributed over a longer time. The side forces and torque become somewhat greater as the muscles are brought into action more strongly in

order to maintain the center of gravity and counteract the displacement tendency of a weight in motion (fig. 10).

Several modifications of the normal gait were introduced. On walking through, with the arms bent to a right angle, a marked increase was noted in the anterior, or fore, and posterior, or aft, forces and also that exerted at the toes.

On raising the hands over the head, still another type of recording

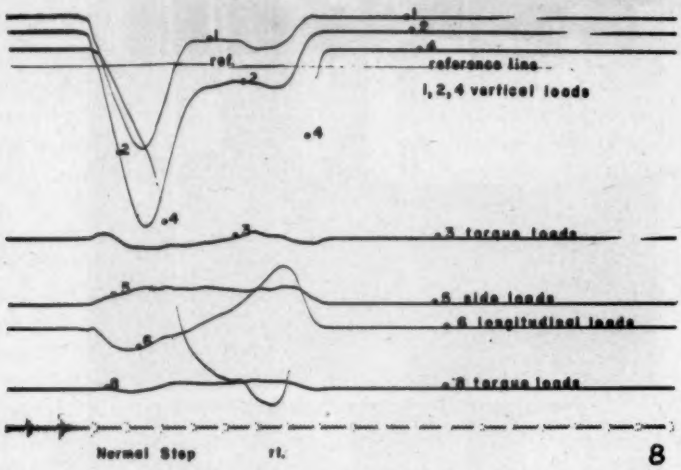


Fig 8. — Oscilliographic recording of the forces recorded from the force plate in the normal gait.

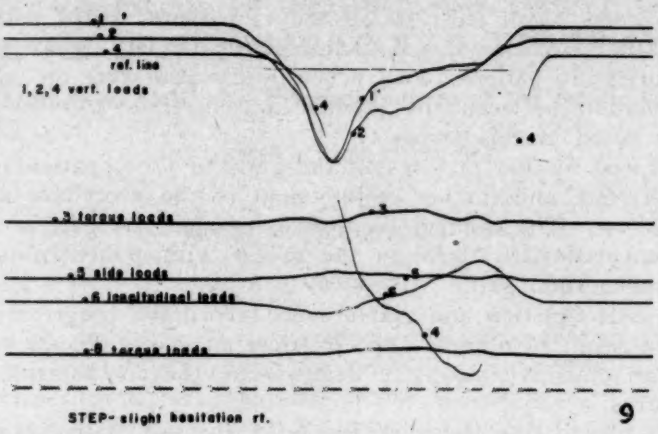
was obtained. The vertical forces applied by the heel were greater and carried this force through a longer period of time, with the result that the vertical forces at the toes were of shorter duration. The rotational torque loads were not quite so large as those measured when the arms were bent or even in the normal gait with the arms swinging at the side.

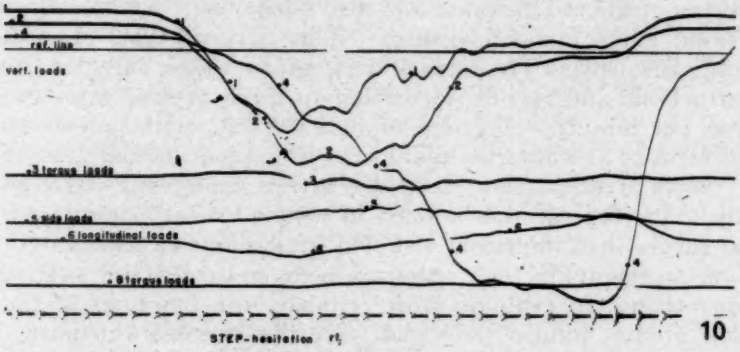
It is thus evident that before any attempt at an analysis of the aberrations in gait resulting from neuromuscular involvement, as may occur in poliomyelitis, normal standards of the varying types of gaits under varying conditions must first be obtained.

Simultaneous oscillographic recordings of the acoustic levels of the joints in action are being obtained and correlated with the force plate measurements and x-ray motion picture studies.

Another phase of this study in functional human anatomy that is under way concurrently concerns itself primarily with the determination of the extent of the neuromuscular involvement present in the patient with poliomyelitis. This information obtained during the past year and a half is being used to correlate the type of gait with the functional disturbances present, so that corrective measures may be based upon an analysis of the functional role taken by the various components of the musculoskeletal system. This work has been carried on at the Corona Naval Hospital with the cooperation of Dr. Edward W. Lowman and at the Rancho Los Amigos (the Los Angeles County Convalescent and Chronic Disease Hospital) with the assistance of Mrs. Elberta M. Arnold.

A manual muscle test followed by electrical testing — i. e., chronaxia of the nerves and muscles — were made and recorded on charts showing the locations of the motor points as found in the patients and the rheobase and chronaxie values for the nerves and muscles tested (fig. 11). These tests were made periodically to record any changes that might occur and their resultant gait modification.





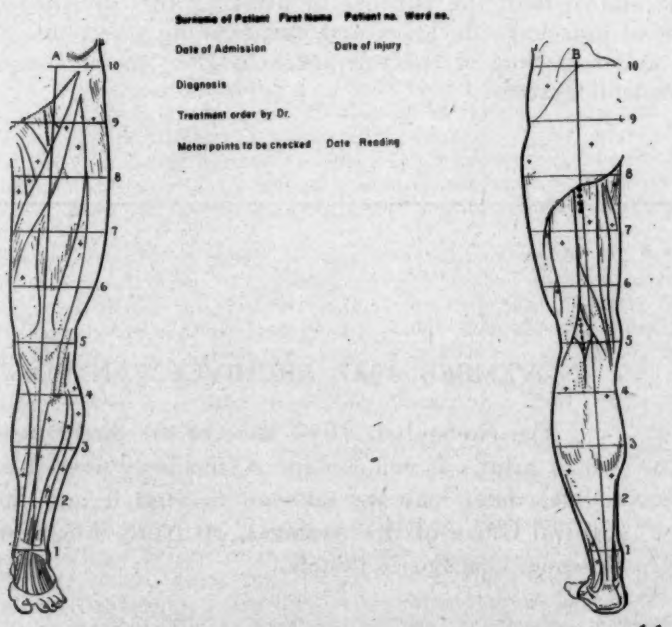


PLATE III

Fig. 9. — Oscillographic recording of the forces exerted when walking through the ramp and hesitating slightly upon the force plate.

Fig. 10. — Longer hesitation upon force plate. The resultant increase in side loading and torque forces can be seen.

Fig. 11. — Muscle testing charts used in mapping areas of muscle involvements. The location of the motor points are recorded and used in diagnosis and electric treatment.

At the Corona Naval Hospital, of the 45 patients tested manually and electrically, 29 were patients with poliomyelitis having involvement of 41 lower extremities; 16 patients with nerve injury also were included in this study. Correlation between the manual muscle tests and the chronaxie readings was noted in this series.

Normal speed motion pictures of the gaits of these patients are being obtained at present, and further employment of the procedure as outlined will be carried on. The changes in muscle function and gait in this group are being compared with those in the group with poliomyelitis and the group with the normal gait.

These muscle function and gait studies record the progressive changes occurring as a result of manual and electrical muscle reeducation programs and provide an objective means of determining the comparative values of these procedures.

A muscle reeducation program, involving the use of electrical stimulation by means of filtered galvanic and also condenser currents superimposed upon galvanic current was instituted. The Bergere, Inc. (Los Angeles), Galconotron was used. Treatments were given twice daily, starting with a few contractions and rapidly increasing to three or four minutes at sixty contractions per minute. A group of nine patients with poliomyelitis having involvement of the anterior tibial muscle graded manually as "trace" or "trace +" were treated twice daily for fifteen minutes at 60 contractions per minute. An increase was noticed in most of these patients within two weeks and several had improved 1 or 1½ grades in one month.

The improvements in their gaits are being recorded and studied as outlined in an attempt to evaluate more critically the functions of the component muscle groups, joint actions and force displacements in normal and in pathologic states, with the purpose of utilizing this information in the development of muscle reeducation and gait-training programs based upon an objective understanding of the role taken by the various components of the musculoskeletal system.

ELECTRODIAGNOSIS OF PERIPHERAL NERVE LESIONS BY MEANS OF INTRAMUSCULAR STIMULATION *

Studies on Cats with Primary Sutures of the Sciatic Nerve

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and

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Although there is a vast amount of literature describing the performance and interpretation of certain familiar diagnostic tests as determined by percutaneous stimulation, we were unable to find any record of a similar study wherein these tests were performed by means of intramuscular stimulation. For that reason, there was devised an investigation in the form of a statistically designed, well controlled, concise experiment to determine the value of these tests in electrodiagnosis when they were performed by the intramuscular method. It was agreed that significance should be judged at the 5 per cent level. This experiment was designed to observe changes in the following electric characteristics during the periods of degeneration, denervation and neurotization in cats following section and immediate suture of the sciatic nerve: (1) cathodal rheobase; (2) chronaxie; (3) repetitive stimulation ratio; (4) cathodal galvanic tetanus ratio.

Material

The material consisted of 6 cats, all of which had a section and immediate suture of the left sciatic nerve. Because of its readily accessible position on the leg, only the tibialis anticus muscle was studied in this investigation.

In order to apply galvanic stimulation to these animals, a constant current impulse stimulator was used.[1] This stimulator was capable of supplying impulses of current having a rectangular waveform to a load circuit which had a variable impedance. By means of this, a predetermined value of current could be sent through the tissue, regardless of wide variations in tissue impedance. There were available seventeen durations of stimulating current ranging from 1 millisecond to 1,500 milliseconds, these values being about evenly spaced on a logarithmic scale. There were also nine values of interval between stimuli ranging from 1 millisecond to 4,000 milliseconds (chart 1).

The indifferent electrode consisted simply of a strip of copper foil 0.0015 x 0.5 x 2.5 inches. It was in all cases the anode and was applied in such a manner as to make good contact with the irregular contour of the cat's foot. Electric connection to it was made by means of a small battery clip, which also served to hold it in place.

The active electrode, or cathode consisted of a steel sewing needle 0.020 inch in diameter and 1 inch long equipped with a small insulated handle and a convenient means for making electric connection to the stimulator. This needle was inserted directly into the muscle about 3/16 inch.

The first examination was done on the eighth postoperative day and the next on the thirteenth day. Thereafter, the animals were examined at weekly intervals up to the fortieth postoperative day and thereafter at ten-day intervals until the ninetieth postoperative day. Immediately after its last examination, each animal was killed.

About one-half hour before each examination, the animal which was designated in the schedule was placed into a cloth sleeve that confined all of its body except its head and left lower extremity. The fur on the anterolateral aspect of the leg and foot was clipped short in order to facilitate making the electric connections and ob-

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The work described in this paper was carried on under a contract which had, initially, the Office of Scientific Research and Development and, subsequently, the Office of the Surgeon General, United States Army, as financial sponsors.

Aided by a grant from The National Foundation for Infantile Paralysis, Inc.

1. Golseth, J. G., and Fizzell, J. A.: A Constant Current Impulse Stimulator, Arch. Phys. Med. 28: 154, 1947.

serving the end points. The anterolateral aspect of the proximal portion of the foot was rubbed with electrode jelly to minimize skin resistance before application of the indifferent electrode.

The active electrode was kept sterile in a solution of metaphen (1:500), and prior to the insertion of the needle into the muscle the area of skin was swabbed with 70 per cent alcohol. A two conductor cable from the stimulator was then attached to the two electrodes.

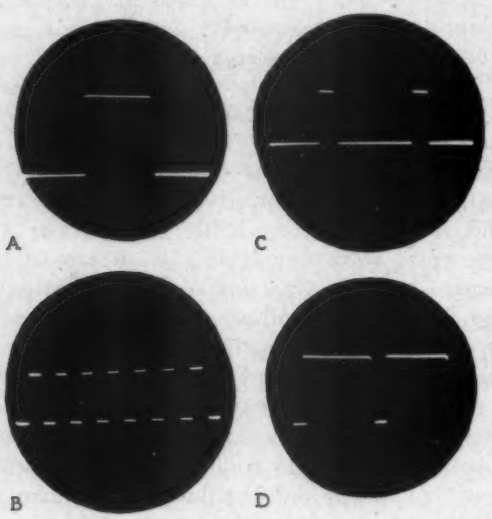

Chart 1. — Oscillograms of constant current stimuli. *A*, single stimulus, 1 millisecond duration; *B*, repetitive stimuli, 1 millisecond duration with 1 millisecond interval; *C*, repetitive stimuli, 1 millisecond duration with 5 millisecond interval; *D*, repetitive stimuli, 5 millisecond duration with 1 millisecond interval.

A careful attempt was made to select and to employ an end point which could be obtained and recognized at all times. The end point which was finally adopted was a minimal contraction of the muscle within a radius of 1 cm. around the needle electrode.

Because it was expected that different portions of a given muscle might exhibit different excitabilities, a scheme of sampling four areas of the muscle was evolved. The length of the tibialis anticus muscle was considered as being divided into quarters, and the needle was inserted into each area to permit a set of readings to be obtained. By means of Tippett's Random Number Tables, a program was prepared which insured sampling the areas in random sequence. This was done to randomize any influence of the stimulating current upon adjacent areas.

At the beginning of an examination on any given area, the rheobase was determined by applying, every two seconds, a stimulus of 1/2 second (500 milliseconds) duration and by varying the current above and below the point of minimal contraction until the specified end point was observed. The value of current which produced this end point was then read on a specially calibrated milliammeter in the stimulator.

A value of current equal to twice the rheobase was then set by means of the controls on the stimulator, and the stimulus duration was reduced in finite steps until the end point was observed. The duration of the impulse which gave the end point was then read from one of the dials on the stimulator and was recorded as the best estimate of the chronaxie of the muscle in that particular area.

In studying the reaction of the muscle to repetitive stimulation, the duration of the stimulus was 5 milliseconds in all tests. The intervals between stimuli were 5 milliseconds, 10 milliseconds and 15 milliseconds. These three possible combinations were applied in random sequence so as to randomize the influence of the stimulating current of one examination upon the succeeding ones. The chosen combination of repetitive stimulating current was applied to the muscle for about 1½ seconds at a time, and the magnitude of the current was varied between successive applications until a full tetanus was obtained as the end point. The peak value of current flowing at that time was measured on a milliammeter in the stimulator. This value of current divided by the previously determined rheobase gave the quantity known as "repetitive stimulation ratio." Three values were obtained for each area, but only the combination of 5 milliseconds' duration and 15 milliseconds' interval was analyzed and plotted.

Before determining the threshold current for cathodal galvanic tetanus, it was desirable to recheck the rheobase using the same stimulus duration that would be used in producing a tetanus. Accordingly, a stimulus duration of 1½ seconds was set on the controls of the stimulator and the current was adjusted to give the specified end point.

When the rheobase had been measured, the value of current was increased until a contraction of the muscle was produced and sustained for 1½ seconds. This latter value of current divided by the rheobase gave the "cathodal galvanic tetanus ratio."

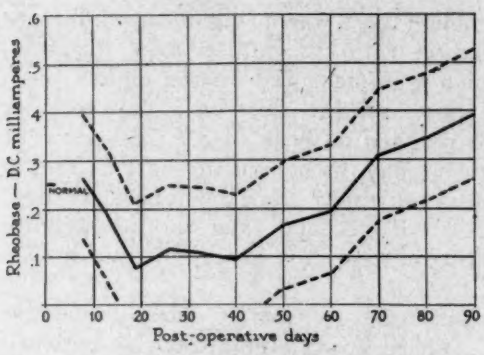

Chart 2. — Rheobase versus postoperative days. The solid curve represents the grand average of all animals; the dotted curves, the "95 per cent confidence limits," showing the uncertainty of the population mean when estimated from the mean of four measurements made on any one animal.

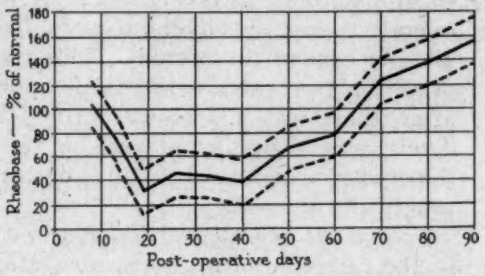

Chart 3. — Rheobase of a hypothetic "average" animal versus postoperative. The solid curve represents the mean of four measurements; the dotted curve, the "95 per cent confidence limits," showing the uncertainty of the population mean.

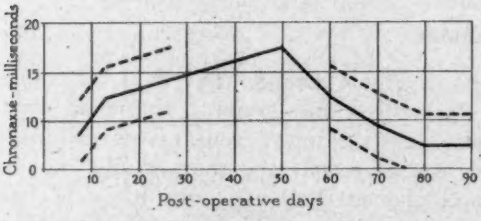

Chart 4. — Chronaxie versus postoperative days. The solid curve represents the grand average of all animals; the dotted curve, the "95 per cent of confidence limits," showing the uncertainty of the population mean when estimated from the mean of four determinations on any one animal.

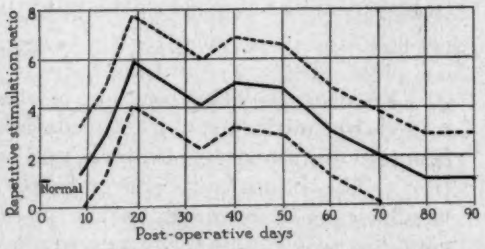

Chart 5. — Repetitive stimulation ratio versus postoperative days. The solid curve represents the grand average of all animals; the dotted curves, the "95 per cent confidence limits" for the means of four readings on any animal.

Experimental Results

Changes in Rheobase. — Chart 2 shows the evolution of changes in the rheobase as determined with the rectangular waves lasting 500 milliseconds. The heavy line connects plotted points, each of which is the average of all four areas on all animals on a specified postoperative day. The average of measurements made on the eighth postoperative day disclosed no appreciable departure from the normal rheobase. At the thirteenth day, however, there had been a highly significant drop, and by the nineteenth day the rheobase was only 37 per cent normal.

Between the nineteenth and fortieth days there was hardly any appreciable change in the level of the rheobase, but on the fiftieth postoperative day there was a significant rise. This was the first step in a steady rising trend which continued to the ninetieth day.

Chart 3 shows these same changes in the rheobase expressed as a percentage of the normal rheobase. Later discussion will show the uses to which this type of curve may be put.

Changes in Chronaxie. — By the eighth postoperative day, in all the areas

which were sampled there were observed chronaxie of 1 millisecond or longer, some areas showing chronaxie greater than 7 milliseconds.

Chart 4 shows the averages of all areas sampled on designated postoperative days. After the abrupt initial rise, there was a gradual lengthening of the chronaxie until the fiftieth post operative day. The examination on the sixtieth day disclosed a sharp decrease, and this began a definite downward trend. Some areas attained chronaxie of less than 1 millisecond on the eightieth post operative day.

Repetitive Stimulation Ratio. — Although there was no significant difference between the normal repetitive stimulation ratio (5 milliseconds' duration, 15 milliseconds' interval) and that which was measured on the eighth postoperative day, the average ratio had risen on the thirteenth day to over 270 per cent of the normal. This ratio reached its peak of 5.9 (550 per cent of normal) on the nineteenth postoperative day, as shown in chart 5. Thereafter, there was a downward trend until the thirty-third postoperative day. There was a significant rise on the fortieth day and then another definite downward trend until the eightieth postoperative day, at which time it was practically normal.

Changes in Cathodal Galvanic Tetanus Ratio. — Chart 6 shows the course of the cathodal galvanic tetanus ratio. There was a significant rise between the eighth and the nineteenth postoperative day. Thereafter, there was a fall on the thirty-third day, and a rise of significance again on the fortieth postoperative day. Subsequent changes appear to have no significance, because from the fiftieth to the ninetieth day the ratios did not differ appreciably from the normal cathodal galvanic tetanus ratio.

Comment

Rheobase. — The function of rheobase versus postoperative days, as determined by intramuscular stimulation, has the same general shape as that function obtained by Pollock and coworkers,[2] using percutaneous stimulation. The important difference lies in the fact that the magnitudes of the rheobase as determined by the intramuscular method are only 10 to 12 per cent of those obtained by percutaneous stimulation. This fact suggests that clinical material showing intolerably high values of rheobase measured by the percutaneous method might be successfully examined by intramuscular stimulation.

The data obtained in this experiment indicate that a single determination of the rheobase is of little or no value as an indication of the true rheobase of the muscle. This is due to the fact that the standard deviation of individual determinations (0.048 milliamperes) was broad compared with the changes exhibited by the averages during the whole course of the experiment. The sampling scheme which was adopted overcame this difficulty fairly well because it yielded an average of four readings obtained from four different points in the muscle. To utilize this latter average effectively, a band of "confidence limits" has been drawn along the curve of chart 2 to show the limits within which the average of four measurements will lie 95 times out of 100.

Chart 3 illustrates the changes in the rheobase of an hypothetic "average" animal with the values of the mean of four measurements expressed as a percentage of the normal. The confidence limits on this function are narrow in comparison with those on chart 2. This means that one can determine with good accuracy the true rheobase when one knows both the normal and the mean of four measurements on the abnormal muscle.

2. Pollock, L. J.; Golseth, J. G.; Arieff, A. J.; Sherman, I. C.; Schiller, M. A., and Tigay, E. L.: Arch. Neurol. & Psychiat. 51:147, 1944.

Chronaxie. — The function of chronaxie versus postoperative days differs in several respects from that obtained by Pollock and coworkers,[3] who studied chronaxie by the percutaneous method. The curves shown in the Pollock's article are for individual animals, while the curve shown in chart 4 is an average of four measurements made upon each of 6 cats. The averaging effect smooths out the latter curve.

It is important to note that the values of chronaxie as determined by percutaneous stimulation and attained by individual animals at their peak (around the fiftieth postoperative day) are from three to five times as high as the maximum average value determined by intramuscular stimulation. In the present experiment, there were recorded only four individual measurements which were slightly greater than 22 milliseconds. All of these were found on the fiftieth postoperative day.

There were placed along certain portions of the curve in chart 4 some "95 per cent confidence limits," which indicate the uncertainty of the average of four measurements made upon the muscle according to the previously mentioned sampling scheme. These limits were omitted along the central portion of the curve because the uncertainty of the average was too great during that period. Investigation of the process for making the measurements revealed that the simplified method of estimating the chronaxie is not sufficiently precise when the values exceed 10 milliseconds.

The data of the present experiment suggest that chronaxie of 1 millisecond or more indicates abnormal muscle but that chronaxie is not a sensitive indicator for use in assessing the progress of nerve regeneration.

Repetitive Stimulation Ratio. — This characteristic shows promise as an aid in electrodiagnosis because of the significant variations which it displayed. Chart 5 shows the trends plotted as a function of postoperative days and it also shows the confidence limits between which the means of four determinations on any animal will lie 95 times out of 100 if the population average is as shown by the heavy line. A ratio greater than 2 indicates abnormal muscle, and a ratio less than 2 when observed sixty days or more after injury or surgical operation indicates well neurotized muscle.

Considering the reliability of the data which this type of examination provides, it appears that a clinical study of this characteristic should be made.

Cathodal Galvanic Tetanus Ratio. — In percutaneous work, Pollock and coworkers[4] had found that the galvanic tetanus ratio dropped to unity in denervated muscle and then rose sharply as neurotization progressed. For this reason, it was expected that this ratio would be a reliable and critical one when measured by intramuscular stimulation. The data yielded by the present series of examination, using the small needle electrodes and intramuscular stimulation, failed, however, to fulfil this expectation. It should be recalled at this point that in normal nerve-muscle preparations, the characteristic response of muscle alone was elicited only when large fluid electrodes were used.[5] The function of this ratio versus postoperative days, as shown in chart 6 does not contain sufficiently great changes to render it a valuable indicator of the condition of the nerve supply in abnormal voluntary muscle.

Because of the absence of critical changes in the curve, this ratio, as measured by intramuscular stimulation, cannot be recommended for clinical study.

Summary

By means of appropriate electronic apparatus, there has been made

3. Pollock, L. J.; Golseth, J. G., and Arieff, A. J.: Surg., Gynec. & Obst. 81:451, 1945.
4. Pollock, L. J.; Golseth, J. G., and Arieff, A. J.: Surg., Gynec. & Obst. 81:660, 1945.
5. Lucas, K.: J. Physiol. 34:372, 1906.

upon each of 6 cats a study of the common electric characteristics frequently employed in electrodiagnosis. The purpose was to follow variations in these characteristics, as measured by intramuscular stimulation, during the periods of denervation and recovery, in a statistically designed and controlled experiment to see which characteristics revealed systematic variations of sufficient magnitude to be significant when compared with their random variations. This would be a measure of their possible usefulness as aids in electrodiagnosis of injuries involving the peripheral nerves in man.

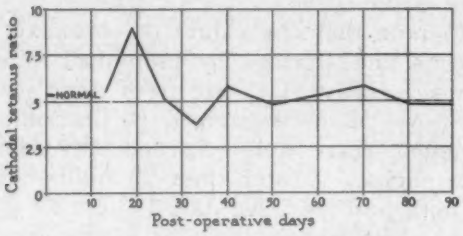

Chart 6. — Cathodal tetanus ratio versus postoperative days. The curve represents the grand average of all

It was found that a single determination of the rheobase of a paralyzed muscle in the cat is worthless for assessing the state of the muscle and its nerve supply because the standard deviation among individual measurements is very large compared with the systematic variations. A single examination which includes sampling the muscle at four points is likewise of little value unless the mean of these measurements is expressed as a percentage of the normal.

The distribution of means of four measurements on any one particular animal is sufficiently narrow to permit this average, when referred to the normal, to serve as a fairly reliable indicator of the condition of the muscle.

One early and important change occurred in the chronaxie prior to the eighth postoperative day. It lengthened from a value appreciably less than 1 millisecond to a value considerably greater than 1 millisecond. The rapid decrease which was noticed between the fiftieth and sixtieth postoperative days was practically coincident with other clinical signs of recovery, such as return of motion and sensation.

During the periods of degeneration and neurotization, the repetitive stimulation ratio exhibits significant changes. Because of this fact and because it can be determined with a good order of precision, it may serve as a reliable indicator of the condition of the muscle and its nerve supply. It would be well to apply this test to a clinical study of human material.

The cathodal tetanus ratio was studied by intramuscular stimulation and the data were examined by analysis of variance in order to separate the variations due to error, due to differences within a given muscle and due to differences between animals. In half of the examinations, the variance due to error was larger than the variance between animals. This was due to the difficulty in determining the end point. There was a lack of correlation between critical points in the curve and known changes in the condition of the nerve supply. From these facts, it appears that the application of this test by intramuscular method to human material is unwarranted.

Conclusions

1. Since the magnitudes of thresholds as measured by intramuscular stimulation were only a small percentage of those measured by percutaneous stimulation, clinical material having intolerably high values as measured by

percutaneous stimulation might be successfully examined by intramuscular stimulation.

2. Using intramuscular stimulation and measuring the rheobase according to a sampling scheme described in this paper, one observes significant changes in degenerating and neurotized muscles in the cat.

3. When measured by intramuscular stimulation, according to a sampling scheme, the repetitive stimulation ratio shows significant changes for degenerating and neurotized muscle.

4. Because these characteristics, which have relatively low thresholds, can be measured with a good order of precision and because they do reveal these significant changes, they recommend themselves for further study in man.

PHYSICAL MEASURES IN TREATMENT OF BURNS

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It has been customary to describe a burn according to the depth of the tissue destruction. Dupytren gives six degrees of tissue destruction, but this is more of a histologic classification than a practical one, with the result that attempts to grade burns clinically have led to much confusion. For practical purposes it is better to divide burns into three degrees: first degree, reddening of the skin; second degree, blister formation; third degree, total destruction of the true skin with or without destruction of the underlying structures.

The extent of a burn is more important than its depth in so far as the prognosis is concerned, but the depth, extent and location of the lesion are the important factors concerned in the treatment. It is often impossible to state specifically the degree of the burn, but its extent can be readily determined. The method of Berkov may be used to advantage for this purpose.

Certain authorities have given the following prognostic sign: in adults first degree burns are fatal if two thirds of the body surface is involved; second degree burns are fatal if one third of the body surface is involved; in children, second degree burns are fatal if one seventh of the body surface is involved.

A large proportion of burns are sterile or nearly sterile at the moment they occur. Every practicable effort should be made to maintain asepsis. The treatment varies from one clinic to the next, but one feature that is common to all is a definite plan of action that must be rigidly adhered to whether the burn be severe or moderate.

The treatment of burns can be resolved into three aspects: life saving, local treatment and preservation of function. Physical measures are employed in all phases, and the modalities most commonly used are thermotherapy, hydrotherapy and mechanotherapy. Usually these measures are important adjuncts to other programs, but at times they may constitute the major or only treatment. They are especially well adapted for promoting healing, minimizing scarring and preventing contractures. Also individual modalities are used but seldom; usually they are combined with one or more

other modalities to produce the desired effect. Thus, hydrotherapy is combined with thermotherapy and often with mechanotherapy.

Severe and extensive burns are rarely of one degree; they are usually a combination of two or of all three degrees in the same area. The methods of treatment presented can be applied to burns in all degrees simultaneously.

Thermotherapy

The application of heat to the body in the immediate treatment of burns has been for years the general accepted procedure. The heat may be applied in different ways — by means of hot blankets, hot water bottles, etc. — and is primarily used with other medicaments to combat shock.

Gautier[1] recommended the use of infra-red radiations only for direct and local treatment of burns. These are started while the lesion is being cleansed. He asserted that the pain would subside within one-half hour, thus permitting the treatment of shock and combating of infection. Healing is accomplished in a much shorter time, and the scars are supple, painless and reactionless, causing no contractures.

Infra-red radiation can be used after any previous type of treatment. It forms a protecting crust after three or four sittings of one hour each. After the crust is formed, treatment is continued twice a day for the same length of time. In second degree burns the epithelization is perfect, but in third degree burns the results are not so good. Gautier did not describe the type of infra-red radiation that he used in his cases.

It would appear that if crusting of the surface is desired the nonluminous type of infra-red rays should be used. Nonluminous heat of long wavelength concentrates its energy in the superficial layers of the skin and is conducted away slowly by the underlying blood. For promoting healing the luminous infra-red radation would be of more value, as it is more rapidly dissipated by the blood in the capillaries and is more effective in stimulating a reflex vasodilatation than the nonluminous type. Also, the skin can tolerate more of this energy.

The length of application of the heat should be determined by the condition of the patient and the extent of the burn. If the local use of heat is continued too long, a general systemic response takes place which may cause grave harm and overshadow any benefits derived from local treatment.

In all stages of burns, heat in form of bakers, heated tented beds, etc., has been used in conjunction with other treatments. The general effect of application of dry heat is to relieve pain and to promote healing and formation of good granulation tissue; besides, it improves the circulation. Dry heat is often applied to wet saline packs and compresses and is used as a preliminary to massage.

Paraffin wax baths are used in later stages of burned extremities and after skin grafts, and they are the best form of heat for these cases. Watkins[2] suggested that this form of treatment should follow several weeks of whirlpool baths, when the epidermis was strong and thick. The optimal temperature is 126 F., which should be thermostatically maintained during the treatment. The effects produced are much greater and longer-lasting hyperemia and relaxation of tense structures. The oily substance in the wax leaves a thin film on the skin, which is an excellent lubricant for the massage which should follow each treatment.

Hydrotherapy

Hydrotherapy, which is the application of water of various temperatures

1. Gautier, J.: Treatment of Burns with Infra-Red Radiator, Presse méd. 47:139, 1939.
2. Watkins, A. L.: A Note on Physical Therapy in Management of Cocoanut Grove Burns, Lippincott Co., 1943.

and pressures, and with various constituents, is an important adjunct in the treatment of burns in all stages and degrees.

In superficial burns — that is, of first and second degree — an immediate application of a 10 per cent sodium bicarbonate compress is very valuable. This dressing should be maintained moist throughout the period of erythema.

In Great Britain the recommended treatment of second and third degree burns of the hands, fingers, face, flexor surfaces and perineum is initially confined to the application of saline compresses or intermittent saline baths for at least one week or until the edema has subsided and sepsis has been controlled. McIndoe[3] recommended in treatment of the hands two or three baths of one hour each during the first day. After removal of the hand from the bath, the burn is covered with *tulle gras*, a curtain net with a mesh of 2 mm. impregnated petrolatum, Peru balsam and halibut liver oil. Then moist saline compresses are applied, and these are moistened every two hours. They are not allowed to dry at any time. At the time of the next bath the dressings are removed down to the *tulle gras*, and the extremity is placed in the saline bath, the *tulle gras* floating off in the solution. In this procedure painful dressings are obviated. The patient is encouraged to move his fingers and wrist joint actively in the bath. Special attention is paid to the interosseus and lumbricales muscles.

At the Massachusetts General Hospital[4] in management of the patients burned in the Cocoanut Grove disaster, wet dressings of boric acid or isotonic solution of sodium chloride were used after the first two weeks. This treatment was used on areas having deep destruction of the skin for expediting the removal of the burned tissues and preparing the surface for skin grafting.

In late burns of the extremities, when crust forms, whirlpool baths may be used. These help to keep the part clean, promoting smooth granulation and diminishing the infection.

Nylin[5] recommended the use of tub baths for treatment of extensive burns. The water is kept at a uniform temperature of 94 to 98 F. throughout the duration of treatment, about one hour. The physiologic effect is derived, according to some investigators, from the fact that the cutaneous nerve endings become swollen from the long contact of the skin with the water and thus produce a sedative effect.

For extensive burns with toxemia, saline baths proved most valuable. Continuous constant temperature saline baths are used for this purpose by McIndoe. He uses a 0.9 per cent saline solution. The patient is left in the bath one-half to one hour and is returned to bed covered with sterile towels and under a heated tented bed. Burned areas are covered with *tulle gras* and dressings, all soaked in saline solution and constantly kept moist. When the normal skin surrounding the burn becomes sodden, the bath can be interrupted for a day or two. During all this time active joint motion is encouraged to prevent stiffening and minimize contractures.

Mowlen[6] has emphasized the fact that extensive burns, in which the whole thickness of the skin has been destroyed, will not heal with a stable scar without contractures or dysfunction. Therefore, he proposes that all effort in management of these burns should be directed toward preparing the area for skin grafting. He advocated the treatment by means of McIndoe's saline baths for long periods each day. If baths are impractical on

3. McIndoe, A. H.: The Functional Aspect of Burn Therapy, Proc. Roy. Soc. Med. 34:56, 1940-41.
4. Cope, O.: Treatment of Surface Burns in Management of Cocoanut Grove Burns, Lippincott Co., 1943, p. 87.
5. Nylin, Joseph B.: Hydrotherapy in Principles and Practice of Physical Therapy, Hagerstown, Md., W. F. Prior Co., Inc., 1946, vol. 3, chap. 21.
6. Mowlen, R.: The Treatment of Burns, Proc. Roy. Soc. Med. 34:221, 1941.

account of the position of the burn or the condition of the patient, saline packs or pads should be used.

Another way of applying saline solution is by the Bunayan-Stannard[7] envelope method of treating burns, which has been developed and tried in Great Britain. The burned areas are enclosed in waterproof envelopes of oiled silk, which are sealed to the skin. The solution used is half-normal saline solution to which is added 2.5 per cent electrolytic hypochlorite. This is run into the envelope, which is agitated slowly to give a flowing motion to the fluid, and after twenty minutes is run out. The irrigation is done three times a day during the infected stage and twice a day thereafter. The temperature of the solution used is 100 F. Between irrigations the wound is left undisturbed; the envelope is left in place undisturbed until the burned area has epithelized completely or until it is ready for skin grafting.

The envelopes are made in various sizes and shapes to meet the need. If there are extensive burns of the trunk, the patient is placed in a collapsible tube, which serves as a bed between irrigations. Bunayan has expressed the belief that this method is valuable because the treatments are painless, prepares a healthy base for skin grafts, allows free movement of limb and thus preventing many deformities, removes dead tissues before they can give rise to toxemia and healing can be observed through the transparent envelope.

I have used the Hubbard tank, and it has proved a successful method of treatment of extensive burns in the later stage. Besides providing the effects of heat, it allows a larger range of motion. Also, when the condition of the patient permits, the agitation of water facilitates the removal of crust and tissue debris. The procedure used was to expose the tank and the water as it filled the tank to carbon arc radiation, to assure as much asepsis as possible. The superficial dressings were removed and the patient immersed in the water. The adherent dressings floated off in several minutes. The duration of the treatment is from one-half to one hour, depending on the general condition of the patient. During it the patient is encouraged to do active movements. Also, moderate active assistive exercises are administered. The Hubbard tank used is equipped with two turbine ejectors, which are used in some cases, thus providing gentle massage. Results obtained have been encouraging, though the number of patients treated does not allow drawing definite conclusions.

Another method of treating acute burns is by refrigeration — be it ice or cold water. Allen[8] stated that "the best emergency treatment is to plunge a burned limb into ice water or even cold tap water. Not only is the pain promptly alleviated but also the subsequent inflammation, blistering and necrosis are reduced to an unparalleled degree." His method of treatment is to apply a single layer of petrolatum gauze over the burned area without cleansing or débridement and refrigeration on top of this dressing. For burned limbs the skin temperature can be reduced to a few degrees above freezing by applying ice or bare ice bags or by the use of refrigerating blankets or air chamber. If the area is large and involves the trunk, a compromise must be reached by which the normal body temperature is preserved and the maximum refrigeration is applied. This means a skin temperature of around 60 to 70 F.

A typical schedule of treatment of a large or neglected area would be a radical refrigeration at about 40 F. for two to four days, after which the temperature of the skin would be gradually raised to 60 to 70 F., which can be

7. Bunayan, J.: Envelope Method of Treating Burns, Proc. Roy. Soc. Med. **34**:65, 1940-41.
8. Crossman, L. W., and Allen, F. M.: Shock and Refrigeration, J. A. M. A. **130**:185, 1946. Allen, F. M.: Refrigeration in General Surgery of Limbs, Am. J. Surg. **68**:171, 1945; Uses of Cold in Medicine and Surgery, Clinics **4**:1642, 1946; The Status of Refrigeration for Military Surgery, Arch. Phys. Med. **26**:92, 1945.

maintained for weeks. This appeared to be the optimal temperature, as Kross[9] reported that a higher temperature caused return of pain and fever. Lower temperatures are not recommended, as they unnecessarily delay healing.

The unique physiologic effect of refrigeration on burns is the simultaneous relief of pain and prevention of shock and infection. These effects are brought about by surface anesthesia, decrease of tissue metabolism and oxygen demand, diminished absorption and formation of histotoxins and inhibition of bacterial growth.[10]

Application of cold to the skin results in decreased flow of blood for the purpose of diminishing the heat loss. Fralick[11] has shown that in the acute cutaneous reaction all surface vessels of the cooled area participate quickly in vasoconstriction. This is the result of local fairly persistent contraction, and a transient generalized reflex contraction through the nervous system. If local cooling is sufficient, a more persistent vasoconstriction may result from the return of cool venous blood to the central nervous system. Thus, the body mechanism is attempting to conserve heat, by generalized vasoconstriction, which brings about an additional decrease in temperature. In this way a fairly deep refrigeration of a local part can be obtained.

Smith[12] stated that the relief of pain is brought about partly by this vasoconstriction and partly by change in nerve conductivity through physicochemical alteration of the lipids by congelation. To this, Allen adds the fact that cold acts as a true protoplasmic anesthetic. The only detrimental effect is some delay in healing during the time of refrigeration.

Because the burns are relatively in the superficial tissues, the application of refrigeration seems to be ideal for this condition. Besides, refrigeration dispenses with the use of opiates, with consequnt benefits to nutrition and strength. Allen stated that there is remarkable regeneration of tissue, resulting in reduction of the need of skin grafting. Refrigeration can be combined with other treatment as the case may demand.

Mechanotherapy

Massage and exercise play an important part in the later treatment of burns, which includes the healed burn per se and those that had to have skin grafting.

Wakely[13] recommends the application of hydrous wool fat for six weeks to a freshly healed burn. This should be rubbed into the area, and the massage will render the skin more supple. The same treatment should be applied to free skin grafts. Giles[14] stated that about two weeks after operation on the skin the grafts start to contract. These grafts may become hard, firmly adherent to the underlying structures and immobile. These complications can be prevented by massage and movement.

This massage should be started as early as possible, and care should be taken not to break the superficial vessels or damage the new skin. It should consist of gentle circular and longitudinal friction from the edge, working to the center of the graft. Watkins[2] emphasized the fact that the friction should be between the skin and subcutaneous layers and the underlying bone tendons and muscles, not, as in the usual procedure, between the technician's fingers and the skin. For old scars or grafts, Giles[14] recommended deep massage with circular kneading movements. This improves the blood and lymph

9. Kross, I.: Low Temperature Therapy for Preservation of Limbs, J. A. M. A. 128:19, 1945.
10. Mock, C. J.: Refrigeration in Surgery, J. Michigan M. Soc. 45:1344, 1946.
11. Fralick, E. H.: Hypothermia in Military Practice, M. Clin. North America, July, 1943, p. 1166.
12. Smith, I. W.: The Use of Cold in Medicine, Ann. Int. Med. 17:618, 1942.
13. Wakeley, C. P. G.: Discussion on the Treatment of Burns, Proc. Roy. Soc. Med. 34:43, 1941.
14. Giles, H.: The Value of Massage in Connection with Skin Graft and Similar Operations in O. F. G. Smith: Rehabilitation, Re-education and Remedial Exercises, Baltimore: Williams & Wilkins Company, 1943, p. 361.

circulation and helps the resolution of scar tissue. Besides these, the hydrous wool fat, olive oil or theobroma oil friction massage helps tremendously in softening of the scars, lessens the irritation when there is undue sensitivity and aids considerably in freeing them from the underlying structures.

There is a varying opinion as to the value of exercise in the treatment of joints involved in a burned area, especially those of the hands and fingers. Many authorities are in favor of early movements, and, as previously stated, they encourage active motion in saline baths, etc. Others feel that exercise increases the formation of scar tissue and effusion into the joints. There is little doubt that most patients derive great benefit from early active motion. An important part of the exercise program is the teaching of relaxation. Patients have a tendency to hold the joints in a certain position and to protect them from all possible changes. They should be made to use them in a natural way as much as possible. Also, the patients should be taught the purpose of these exercises, so that they will acquire an interest and understanding of the ultimate goal.

In treatment of burns in the early stage splints are usually used. Cohen,[15] using tannic acid as the main treatment, removes splints from hands and fingers on the seventh day and starts motion. This is done because, unlike other healthy joints, which can be immobilized for a considerable time and a full range of motion expected, the fingers tend to remain stiff and the return of full function is much delayed by longer splintage. The explanation may be the fact that other joints are enveloped by muscles which, despite immobilization, continue to exert some activity, thus causing massage and maintaining the circulation in the lymphatics. In the fingers there are no muscles, and Cohen believes that unless tendon movements are retained lymph stagnates and becomes organized around the joints.

Passive exercise should be started early in the contracted areas. The movements should be slow and the range controlled by the appearance of pain or discomfort. Although the joint may stiffen directly after treatment, the result of several weeks' exercise will be a permanent increase in movement. Frequency of repetition of exercises has to be controlled, as excess will lead to blister formation (Watkins).

Active exercise should be encouraged. Brown and coworkers[16] have recommended active motion in skin grafts following burns as soon as the condition permits. They found that postoperative stiffness and secondary contractures in many cases of axillary and brachial scars are relieved promptly by simple exercises and play. If the patient exercises the affected area early, there is a prompt restoration of function.

Exercise should be graded carefully and should start with a mild form. In this connection, occupational therapy of the kinetic type is useful. Patients with hand injuries especially should have this form of therapy prescribed. Various arts and crafts, such as knot tying, scarf making and light carpentry, are most suitable, as they develop complex functions and coordinations of motion. As improvement continues, heavier exercise and occupational therapy can be added.[17]

Other modalities of physical medicine are rarely used in treatment of burns. Gautier[1] used ultraviolet radiation for early burns but discarded it. Peck[18] stated that the healing period of extensive burns may be greatly shortened by the use of ultraviolet rays. The value of ultraviolet radiation in the

15. Cohen, S. M.: The Treatment of Burns, Brit. M. J. 2:251 and 754, 1940.
16. Blair, V. P., and Brown, J. B.: Physical Therapy in Plastic Surgery in Principles and Practice of Physical Therapy, Hagerstown, Md., W. F. Prior Company, Inc., 1946, vol. II, chap. 12, Brown, J. B.: Blair, V. P., and Hamm, W. G.: The Release of Axillary and Brachial Scar Fixation, Surg. Gynec. & Obst. 56:791, 1943.
17. Reidy, J. P.: The Relation of Physiotherapy to Plastic Surgery, Proc. Roy. Soc. Med. 37: 705, 1944.
18. Knapp, M. E.: Ultraviolet Therapy, Clin. Med. & Surg. 47:148, 1940.

later stage of burns is not as yet established, but applied locally it would seem to stimulate healing and decrease infection by its bactericidal action. Applied generally, it improves the general condition of the patient. It is important to remember that oily films on the skin, such as remain after petrolatum or other ointment dressings, reduce the reaction because the rays will not penetrate through this film. A higher dose of radiation is required.

Some authorities recommend short-wave diathermy and galvanism in treatment of later stages of burns. These may be of value in certain cases, but as yet the effectiveness of these modalities has not been proved in the general treatment of burns.

Summary

1. Various physical measures in treatment of burns are reviewed and discussed as to their merits and mode of application.

2. The modalities most commonly used are thermotherapy, hydrotherapy and mechanotherapy. Usually these measures are important adjuncts to other programs, but at times may constitute the major or only treatment. The methods presented can be applied to burns of all degrees.

3. The primary mission of physical medicine in treatment of burns is the preservation of function. Stress is placed on early mobilization, to prevent contractures and deformities. Physical medicine is also used to great advantage in life saving and in local treatment of burns.

SPECIAL HAND SPLINTS FOR THE DISABLED *

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HINES, ILL.

Any procedure that will aid disabled persons to perform essential activities will definitely help toward attaining the maximum in rehabilitation. Many patients who have complete or partial loss of function of one or more extremities due to disease or injury can frequently be helped by the use of special splints. This article is not intended to be revolutionary in character, as many splints have been made in the past to help increase function of various parts of the body. However, several types of special splints will be described with the hope that the description will further stimulate interest along this line of endeavor to make the disabled person more self-sustaining. These splints not only will help to secure certain definite movements for specific functions but will be a tremendous factor in elevating the morale of the handicapped.

All splints should be light in weight, easily applied and removed and of such material that they can be thoroughly cleansed. The splints should be individually fitted to the patient in order to secure maximum benefit. Most splints have been made of plastic with the addition of necessary straps and pads; such splints should be so designed that the straps and pads can be easily removed when soiled. Only three of these special plastic hand splints, used by patients at the Veterans Administration Hospital, Hines, Ill., are illustrated in this article. However, many others have been made to help in performing other activities.

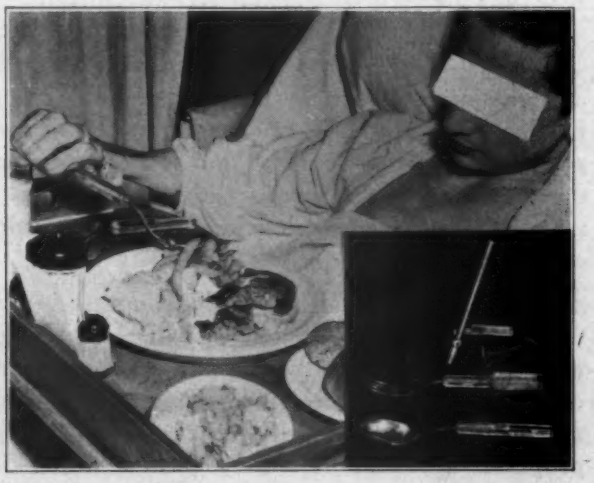

Fig. 1. — Plastic hand splint with removable eating utensils and special attachment for pen or pencil.

Figure 1 shows a patient using a special plastic hand splint with removable eating utensils and attachment for pen and pencil. This patient suffered a spinal cord injury resulting in a complete paralysis of both lower ex-

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tremities and a partial paralysis of both upper extremities. There is complete loss of function of both hands and all fingers and only partial function of the shoulders and elbows. With this special splint, the patient can feed himself, write, or draw in a very satisfactory manner. Without the splint the patient cannot perform these activities. In some cases, when there is no voluntary motion in the elbow it may be necessary to use a simple splint to immobilize the elbow in the optimal position to permit the patient to feed himself or write by merely using shoulder movements in bringing the hand toward the desired place.

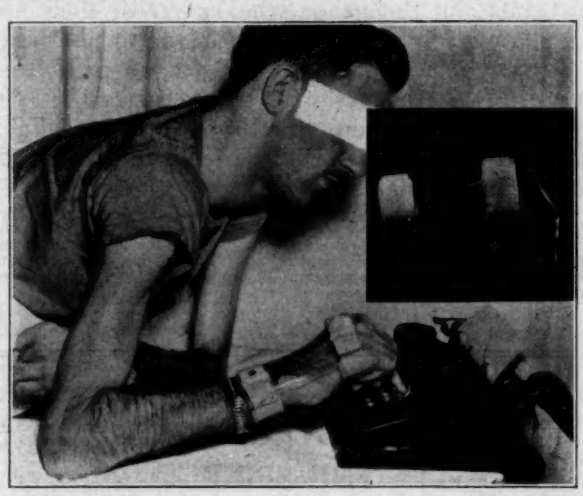


Fig. 2. — Special plastic hand splint for one finger typing.

Figure 2 shows a patient with complete loss of function of his hands and fingers following injury. With the use of this special plastic splint he is able to operate a standard typewriter to do one finger typing. The hooklike end of the splint immobilizes one of the fingers in the optimal position for this particular activity.

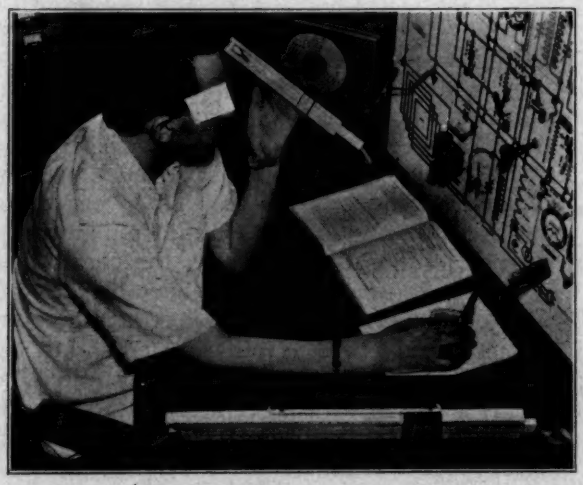


Fig. 3. — Special attachments for standard slide rules and also hand splints for pen or pencil.

Figure 3 shows a patient with complete loss of the use of both lower extremities resulting from a spinal cord injury. However, he has partial use of both shoulders and elbows. This patient is enrolled in a course of in-

struction in radio engineering while at the hospital. It is essential that he use a slide rule and write in order to pursue his engineering studies successfully. This patient has been fitted with a special splint with a pen and pencil attachment to that shown in figure 1. In addition, his slide rule has been fitted with a plastic handle and two leather loops which enable him to operate it very accurately.

Many other special splints and devices can be made for use of patients with various other types of disabilities. Special hand attachments have been constructed to enable persons who have no voluntary or limited voluntary motion in their hands and fingers or who have lost their fingers to handle crutches for ambulation. Splints have been made to hold crayons and paint brushes for those who wish to participate in art. A careful evaluation of all patients who have impaired function of their extremities should be made, for, in many cases, one with ingenuity and some mechanical ability can design a splint or other device to enable these patients to perform activities which would otherwise be impossible.

I am greatly indebted to the Nursing Staff on the Paraplegia Service, the members of the staff of the Occupational Therapy and Manual Arts Therapy Sections, Medical Rehabilitation Service and to the staff of the Brace Shop, Veterans Administration Hospital, Hines, Illinois, for their ideas and aid in the making of these special splints and to the Medical Illustration Laboratory at this hospital for the photographs.

A SLIDING FRAME FOR STRETCHING AND EXERCISING THE SPINE

E. H. WEISSENBERG, M.D.

NEW YORK

There are many different methods of passively stretching the spine in the standing, sitting or lying positions. The mechanical force may be applied manually or by other forces. A headgear (Sayre sling) is used to pull the spine upward while gravity pulls it downward (in standing and sitting positions). Head and feet may be fastened by stirrups, and, while the patient lies horizontally, a pull may be made in opposite directions.

One can compare the spine to a chain whose members are linked by ligaments and muscles. Owing to the difference in size of the vertebrae, the joints of the cervical portion of the spine are much weaker than those of the thoracic and lumbar portions. Just as a chain under stress will always give first at the weakest link, so a pull on the spine will be more effective on the weaker, smaller joints. Consequently, the cervical part of the spine will be stretched first and usually cause unbearable discomfort before the pull can be effective on the heavier, lower parts of the spine.

All stretching methods, as they have been used so far, have one common characteristic: they provoke strong muscular contractions, and any stretching effect produced is achieved against induced reflex muscular contraction.

The apparatus to be described[1] makes it possible to stretch the spine in relaxation, with the added advantage of exercise while the spine is under traction.

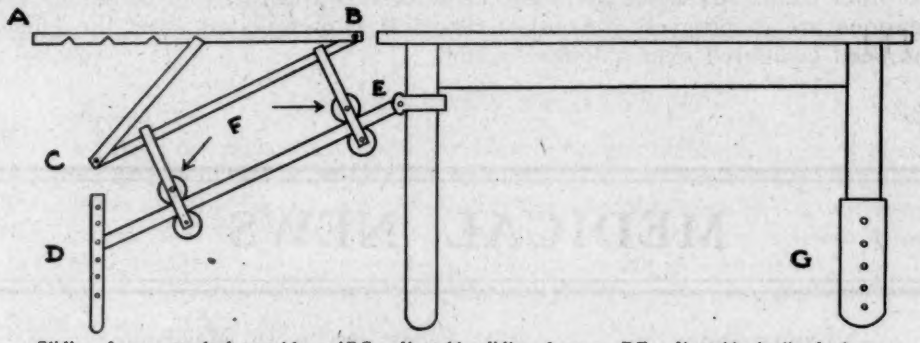
In principle, this apparatus is an inclined plane on which two frames slide with gravity. The construction provides for a minimum of friction between the sliding parts. The two frames are joined by hinges and are braced

1. This apparatus is being developed at the Columbia Presbyterian Medical Center.

against each other. Straps of webbing are fastened across the upper frame. The entire structure is attached to an ordinary hospital table as it is used in any physical therapy department for treatment.

To stretch a patient's spine the following operations are necessary:

1. The frames are pushed upward until they touch the table and are fixed in that position to prevent them from sliding back.



Sliding frame attached to table. *ABC*, adjustable sliding frames; *DE*, adjustable inclined plane; *F*, wheels; *G*, elevating device.

2. The patient puts on a pelvic belt that has a strap on each side.
3. The patient is put on the hospital table supine or prone.
4. He moves toward the frames until only his legs and pelvis are resting on the table. His head and the upper part of his body are then supported by the straps across the frame.
5. The straps of the pelvic belt are fastened on each side of the table.
6. The lower end of the table is raised to whatever height is wanted for this particular patient (to select the desired pelvic tilt).
7. The mechanism that holds the frames in the starting position is now released.

At once the frames will move downward by gravity, taking along with them that part of the body which rests on the straps, so far as the structures attached to the spine will yield. This creates a pull on the spine and, in particular, on that portion which now stretches unsupported between the table and the frames.

By careful positioning of the patient, traction can be produced on any part of the spine. If gentle traction is indicated, the plane is inclined slightly. On the other hand, if a stronger force is desired, the inclined plane is lowered and possibly additional weights are hooked on the sliding frames. No securing of the patient is necessary in the first instance, whereas in the second it might be necessary to fasten the sliding part of the body to the frame and the pelvis to the table.

While the patient is being stretched he can receive additional physical treatment, such as heat or massage.

The patient has complete freedom for exercising his extremities. Exercises for the spine are made possible by a special construction of the straps across the frame. Each webbing strap is attached at both ends to a stout elastic band. In this way the patient resting on the straps is virtually suspended by the elastic bands, which give easily if the body shifts sidewise or rotates. When the straps are adjusted in such a way that only one elastic band is fastened to the frame and the other end of the webbing is fixed rigidly to the other side of the frame, the body is automatically rotated toward the side of the elastic band. This position can be used advantageously for the stretching and derotation of the spines of patients with scoliosis.

The patient normally lies in a horizontal or slightly inclined position.

If this does not feel comfortable for the patient, his head is supported by a pillow or, if necessary, the upper frame is braced higher against the lower frame, like an elevated back rest.

The apparatus described has been tested so far on a small number of patients with arthritis, low back pain and scoliosis. Patients treated in this way received considerable relief from pain within ten or twenty minutes. No other claims are made as to the value of this apparatus. Further investigations are in progress. Another report is contemplated after the effect has been evaluated over a longer period.

MEDICAL NEWS

Examinations
American Board of Physical Medicine

The American Board of Physical Medicine, through its Secretary, Dr. Robert L. Bennett, announces that the dates and locations of the next examinations for certification to the Board will be as follows: Chicago, June 18 and June 19, 1948; Washington, D. C., September 4 and September 5, 1948.

Mr. Baruch Addresses Prepaid Care Plans Dinner

The Medical Society of the State of New York, the Coordinating Council of the Five County Medical Societies of Greater New York and the Greater New York Hospital Association sponsored a dinner November 19 at the Hotel Biltmore. A report was made on the progress of prepaid medical and hospital care in the New York area by the United Medical Service, the Doctors' Plan and Associated Hospital Service, and New York's Blue Cross Plan. The guest speaker was Mr. Bernard M. Baruch.

Dr. Paul B. Magnuson Gets VA Appointment

Announcement is made of the appointment of Dr. Paul B. Magnuson, former professor of surgery and chairman of the Department of Bone and Joint Surgery at Northwestern University Medical School, Chicago, as acting chief of Veterans Administration Professional Services.

Dr. Magnuson came to VA in November, 1945, on six months' leave from Northwestern and from his duties as attending surgeon at Passavant Memorial Hospital and senior consulting orthopedic surgeon at Wesley Memorial Hospital, to assist Dr. Paul R. Hawley, VA's chief medical director, in reorganizing medical care for veterans. He has been with VA since as acting chief of the Research and Education service. As acting head of Professional Services, which includes general medicine and surgery, neuropsychiatry and the tuberculosis service, Dr. Magnuson succeeds the late Brig. Gen. Elliott C. Cutler, who died August 16, 1947.

Dr. Edward Harvey Cushing, former associate clinical professor of medicine at Western Reserve University, Cleveland, Ohio, will succeed Dr. Magnuson as chief of the Research and Education Service.

Dr. Dawson Succeeds Dr. Covalt on Rehabilitation Service

Dr. Donald A. Covalt, chief, Veterans Administration physical medicine rehabilitation service, resigned, effective November 15, to become associate professor of physical medicine and rehabilitation at New York University School of Medicine and head of the university's new Rehabilitation Institute. Dr. A. Ray Dawson, head, physical medicine rehabilitation service in the Richmond, Va., branch office will succeed Dr. Covalt.

Dr. Dawson graduated from the Medical College of Virginia, served a residency in psychiatry at St. Elizabeth's Hospital, Washington, D. C., and for six years was with the U. S. Civil Service Commission. During the recent war he was on duty in the office of the Surgeon General, in the office of the Air Surgeon, and was a flight surgeon.

Dr. Covalt, a graduate of Indiana University Medical School, practiced in Muncie, Ind., for about nine years. He served as chief of rehabilitation for the air corps and recently was in charge of establishing medical rehabilitation units in the Veterans Administration's hundred and twenty-six hospitals.

Sound Physical Medicine Pays Off (Hawley)

The Information Bulletin of the Department of Medicine and Surgery of the VA issued a special issue on Medical Rehabilitation in Sept., 1947. Dr. Paul R. Hawley, Chief Medical Director, VA, before the annual meeting of the New York State Com-

(*Continued on page 778*)

ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

A NEW YEAR'S MESSAGE

Another year is passing and once more another milestone in the progress of Physical Medicine has been accomplished. This — the twenty-fifth anniversary year of the American Congress of Physical Medicine — has witnessed the birth of the American Board of Physical Medicine. My special thanks go to the members who contributed so much to make this event possible. It is now our individual responsibility to maintain the principles for which the Board stands at an equable standard.

To — the officers and committee chairmen may I express my thanks for your willingness to give of your time. This is a fine spirit of cooperation.

To — each member of the Congress may I express my whole-hearted appreciation for your many contributions.

To — the advertisers whose sustained support has contributed to the maintenance of the ARCHIVES may I express our sincere appreciation.

To — the technical exhibitors, who year after year have materially assisted in making our meeting a success, I wish to express the gratitude of the Congress.

Physical Medicine has continued to broaden its scope of therapeutic and diagnostic usefulness, however, it is our individual responsibility to see that progress continues. It is only fitting at this time, when the pages of time are turning to a new year, that we inventory our contributions for 1947 and set our 1948 goals for even higher planes. No one will disagree that much has been accomplished, but we must realize we have even more to learn. The removal of empiricism in the therapeutic modalities of Physical Medicine is forever our challenge. Physical Medicine has and will continue to play a major role in maintaining health and longevity of life. Let us resolve to constantly increase the patient's opportunities for better health.

As stated by James S. McLester — "In the past, science has conferred on those people who avail themselves of the newer knowledge of the treatment of disease, a better health and a greater average length of life. In the future it promises to those who will take advantage of the newer knowledge of scientific researches, increased longevity and a higher level of cultural attainment. To a measurable degree, man is now master of his own destiny where once he was subject only to the grim hand of fate."

Let us be mindful that an organization is only as successful as its members are industrious, conscientious, cooperative and loyal and pledge ourselves to make the year 1948 the greatest in our history.

To — all

The Season's Greetings,

H. WORLEY KENDELL, M.D.,
President.

FURTHER STUDIES ON MUSCLE PHYSIOLOGY

During the past year, many articles and editorials on muscle physiology and exercise have appeared in the ARCHIVES. This serves to emphasize the growing importance of this subject in the field of physical medicine. Since we are publishing in this issue two important articles: one on electrodiagnosis by intramuscular electrical stimulation and the other on a study of the human gait, we shall again devote some editorial space to this phase of physical medicine.

As in all of the medical and surgical specialties, so also in physical medicine, the specialist deals both with diagnosis and therapy. It is true that many patients come for treatment with the diagnosis adequately established, but others are referred for the diagnostic help which the physiatrist has to offer. In the disturbances of the neuromuscular mechanism, much of the diagnostic study is in the realm of physical medicine.

The old galvanic and faradic tests for reaction of degeneration have given place largely to the more accurate chronaxie determination. Functional manual muscle testing has been standardized and placed on a uniform basis. Electromyography shows promise as a method of physiologic study and diagnosis, but as yet is not widely available and norms are not well established.

A further refinement in muscle testing is presented in this issue of the ARCHIVES by Golseth and Fizzell.[1] These investigators studied the rheobase, chronaxie, repetitive stimulation ratio and the cathodal galvanic tetanus ratio values by means of intramuscular stimulation in cats with sectioned and sutured sciatic nerves. By repeated determinations over a period of ninety days, degeneration and regeneration curves were constructed. The observations are of considerable interest and significance.

In all of these tests, the thresholds as measured by the intramuscular needle electrodes were only a small fraction of those obtained by the percutaneous route. The authors point out that the intramuscular method would be of clinical importance in patients whose percutaneous values were so high that they could not tolerate the current necessary to produce the desired response.

Of the four procedures, only the cathodal tetanus ratio, contrary to expectations, failed to be of value when determined by the intramuscular route. The authors found the repetitive stimulation ratio using a 5 millisecond stimulus with an interval of 15 milliseconds and a duration of one and one-half seconds to show significant changes for degenerating and neurotized muscle. They recommend this method for clinical trial in the human. Rheobase determinations are necessary for both the chronaxie and the repetitive stimulation tests, but the authors point out that single rheobase values are not sufficiently accurate because of a large standard deviation among individual measurements. They therefore tested four areas of the muscle in random sequence and the mean of these measurements was expressed as a percentage of the normal.

The intramuscular method of electrical muscle testing appears to be a worthwhile contribution, especially applicable in those patients who exhibit intolerance to the percutaneous technic.

The other article on neuromuscular function is that by Rehman[2] on kinematics and dynamics of the human gait. This is a preliminary report of an ambitious study of the various factors in the human gait, including muscle function, joint motion and the various force loads. Those who have had an

1. Golseth, J. G., and Fizzell, J. A.: Electrodiagnosis of Peripheral Nerve Lesions by Means of Intramuscular Stimulation, Arch. Phys. Med. 28:757 (Dec.) 1947.

2. Rehman, I.: A Study of the Kinematics and Dynamics of the Human Gait and Its Application in Poliomyelitis, Arch. Phys. Med. 28:749 (Dec.) 1947.

opportunity to see Dr. Rehman's laboratory at the University of Southern Californa will agree that the experimental arrangement used in this study is exceedingly ingenious and complete. The apparatus is so arranged that simultaneous or closely sequential motion pictures, oscillographic records of the various force loads, and x-ray motion pictures of joint motion can be made. Already, as indicated in this present paper, some unexpected and interesting results have been obtained. The x-ray motion picture showing joint function exhibited at the meeting of the American Congress of Physical Medicine last year was a part of this study.

Both of these articles on neuromuscular function are recommended to our readers for careful perusal.

THE PHYSICAL THERAPY OF RHEUMATOID ARTHRITIS

In a recent editorial in the Journal of the American Medical Association[1] the editor concluded by saying that the only established methods for the treatment of arthritis are physical therapy, orthopedic treatment and such analgesics as seem indicated. All other methods were dismissed as still experimental and unproved. This opinion regarding physical therapy is generally held by those dealing with the chronic arthritides.

The physical therapy of rheumatoid arthritis consists of local and general heat, massage and exercise. The iontransfer of the vasodilating drugs, histamine and mecholyl, is also of considerable value in this form of arthritis.

Local heat may be applied by means of the hot moist pack, the infra-red lamp, the hot paraffin bath, or diathermy. The paraffin bath is especially satisfactory for treatment of the hands and feet which are easily immersed. The patient is usually instructed in the home use of the paraffin bath. The author rarely uses diathermy in rheumatoid arthritis.

The local application of heat is usually followed by massage to the muscles adjacent to the involved joints, but not to the joints themselves. Joints should be moved daily through the maximum tolerated range of motion, actively if possible but with assistance if necessary. Pain following joint motion which does not persist more than two or three hours does not contraindicate continuance of the exercise program.

The general application of heat may be in the form of mild fever therapy, mild heating in the Hubbard tank, or the hot tub bath in the home. Although fever therapy is not curative in rheumatoid arthritis, it does relieve joint pain and swelling in well over half the cases treated and, if followed by the rest of a good treatment program, is valuable adjuvant therapy. We have found the use of the Hubbard tank according to the method described by Currence[2] to be effectve in many cases.

In this method, the patient is placed in the Hubbard tank at a water temperature of 98 to 100 F. The temperature of the water is gradually raised to 104 to 106 F. and the patient stays in the tank until his temperature reaches 100 to 101 F. During the time he is in the tank he is given underwater exercise to his extremities. He is then removed from the tank to the treatment table, covered, allowed to cool gradually, and is finished with massage to the muscles adjacent to the involved joints. The treatment should be given twice or three times weekly.

The vasodilating drugs histamine and mecholyl produce a fairly prolonged vasodilatation when applied locally over the joint from the positive

1. Edit., J. A. M. A. 135:288 (Oct. 4) 1947.
2. Currence, J. D.: Underwater Therapy in Arthritis, Arch. Phys. Therapy 16:291 (May) 1935.

terminal of the direct current apparatus. They are absorbed from the local area and histamine has frequently been observed to produce systemic effects such as headache and flushing of the face. They are often distinctly helpful in rheumatoid arthritis.

An important consideration in the treatment of this disease is posture both in and out of bed. If the patient is confined to bed, it is usually well to place a piece of plywood between the mattress and the spring. Flexion contractures of the joints, especially of the knees, should be avoided, by the use of splints if necessary.

Physical therapy is usually only a part, although a very important part, of the treatment program in rheumatoid arthritis. It should be carefully prescribed and followed if the best possible result is to be obtained.

Medical News

(Continued from page 774)

mittee on Tuberculosis and Public Health of the State Charities Aid Association, said: "The Medical Rehabilitation Service of the Veterans Administration is a new service. . . . It now includes Physical Therapy, Occupational Therapy, Corrective Physical Rehabilitation, Educational Therapy Manual Arts Therapy. The veteran patients can receive, not alone acute care from the Physical Medicine Section, but he is also supplied a motive to leave the hospital when he is physically able."

VA Medical Rehabilitation Personnel

	—Full Time— Jan., 1946	July, 1947
Doctors of Physical Medicine	25	81
Physical Therapists (qualified)	102	531
Occupational Therapists (qualified)	115	432

In addition 366 VA corrective therapists were handpicked from some 20,000 persons formerly in the physical reconditioning programs of the Army or Navy.

Open School of Physical Therapy

The University of Colorado Medical Center opened its School of Physical Therapy this fall. The medical director is Dr. Harold Dinken, associate professor and director of the department of physical medicine and rehabilitation of the Medical School and Hospitals of the Center. Miss Mary Lawrence is the technical director.

Physical Therapists

There is a need, at the present time, for a number of Physical Therapists at the Veterans Administration Hospital, Hines, Illinois. These therapists must be graduates of approved schools. The bed capacity at Hines is approximately 3,500, consisting of general medical, general surgical, neuropsychiatric and tuberculosis. At present, housing is available at the hospital. If interested, complete Civil Service Application Form No. 57 which can be secured at any postoffice and mail to Dr. Louis B. Newman, Chief, Physical Medicine Rehabilitation Service.

Residency Stipend in Veterans' Administration Hospitals

The Veterans Administration has announced that the stipend for resident physicians who are veterans is $275 per month. When subsistence and maintenance are furnished by the Veterans Administration, the resident reimburses the Veterans Administration (approximately $50 per month). For nonveteran physicians the pay is graded—junior, intermediate and senior. Salary is separate from subsistence and maintenance.

Industrial Health Congress

The eight annual Congress on Industrial Health will be held at Cleveland, Ohio, on January 5 and 6, 1948, in conjunction with the mid-winter meeting of the House of Delegates of the American Medical Association.

Ohio State University Offers Graduate Courses in Rehabilitation

The School of Social Administration at Ohio State University is offering a new graduate curriculum in rehabilitation, developed in consultation with the Office of Vocational Rehabilitation and other national voluntary and public agencies interested in the rehabilitation of the handicapped. It is also based on three years' experience with the undergraduate program in the School of Social Administration.

Your A. M. A. Directory Information Card

Preparations are now being made to publish the new, Eighteenth Edition of the American Medical Directory. The last edition of the Directory was issued late in 1942. Since that time, it has been impossible to publish a new edition because of wartime restriction and the shortage of paper and labor.

About Nov. 15, a directory card was mailed to every physician in the United States, its dependencies, and Canada, requesting information to be used in compiling the new Directory. Physicians receiving an information card should fill it out and return it promptly whether or not any change has occurred in any of the points on which information is requested. It is urged that those physicians also fill out the right half of the card, which information will be used exclusively for statistical purposes. Even if a physician has sent in similar information recently, mail the card promptly to insure the accurate listing of his name and address. There is no charge for publishing the data nor are physicians obligated in any way.

The Directory is one of the most important contributions of the American Medical Association to the work of the medical profession in the United States. In it, as in no other published directory, one may find dependable data concerning physicians, hospitals, medical organizations and activities. It provides full information on medical schools, specialization in the fields of medical practice, memberships in special medical societies, tabulation of medical journals and libraries, and indeed, practically every important fact concerning the medical profession in which anyone might possibly be interested.

Therefore, should any physician fail to receive one of these Directory Information Cards by December 1, he should write at once to the Directory Department requesting a duplicate card be mailed.

Cerebral Palsy Clinic at Kalamazoo

A two-day cerebral palsy clinic, the second this year, will be held at Bronson Hospital, Kalamazoo, December 9-10, under the auspices of the Kalamazoo County chapter of the Michigan Society for Crippled Children. Dr. Meyer A. Perlstein, Chicago, will again be the examining physician. The clinic will be open to cerebral palsy victims up to the age of 21 years who are referred by their own physicians and have cleared through the field representative for the county crippled children's chapter.

Recall Quota for Dietitians and Physical Therapists

In accordance with authority recently granted by the Department of the Army, a recall quota for Dietitians and Physical Therapists has been established.

Officers in these two categories who served honorably during World War II and who are now on inactive status may request extended active duty in the Army of the United States. This personnel will be recalled to active duty in the grade held prior to reporting to a Separation Center. Individuals desiring to apply for extended active duty should make application in writing and must be unmarried, have no dependents under 14 years of age, and be physically qualified.

Application blanks may be obtained from The Adjutant General, U. S. Army, Washington 25, D. C., or from The Surgeon General, U. S. Army, Washington 25, D. C.

Research on Orthopedic Appliances

A multiple research fellowship on orthopedic appliances has been established at the Mellon Institute, Pittsburgh, by the Sarah Mellon Scaife Foundation of Pittsburgh. Under the guidance of orthopedists and with the cooperation of leading organizations in the field and manufacturers of orthopedic appliances, the fellowship will accord particular attention to problems of mechanical design, improvements in materials of construction and methods of fitting braces and other orthopedic devices. John L. Young, Ph.D., a research specialist in metallurgy and mechanical engineering who has been active on the investigatory staff of Mellon Institute since 1928, heads the program as senior fellow and assistant director. Eugene F. Murphy, M.E., staff engineer, committee on artificial limbs, National Research Council, Washington, D. C., will serve as advisory fellow. Several research assistants will complete the initial personnel of the fellowship. The medical advisory committee of the fellowship is under the chairmanship of Dr. Paul B. Steele, professor of orthopedic surgery, University of Pittsburgh School of Medicine. Other members of the committee are Drs. John A. Heberling and Carl C. Yount.

Research on Radioactive Substances

Under a $100,000 grant from the U. S. Atomic Energy Commission, Western Reserve University School of Medicine, Cleveland, will conduct research on the effects of radioactive substances and atomic energy on the body and on living cells. Dr Hymer L. Freidell, professor of radiology, will direct the project and Dr. Arnold D. Welch, head, department of pharmacology, and Harland G. Wood, Ph.D., head, department of biochemistry, will be consultants. Paul A. Mattis, Sc.D., former professor of pharmacology, University of Florida School of Pharmacy, now at the Western Reserve School of Pharmacy, will direct the pharmacologic division of the project. Dr. Paul S. Lavik, assistant professor of biochemistry in the school of medicine, will study the effects of radioactive elements on enzymes and will supervise the work of the biochemical division. This research will be related to that conducted in several other institutions by the Atomic Energy Commission.

BOOK REVIEWS

DIE SIGNALÜBERMITTLUNG IM NERVEN (Signal Transmission in Nerve). By *Alexander von Muralt,* M.D., Ph.D., Professor of Physiology at the University of Berne (Switzerland). Textbooks and Monographs on Exact Sciences, No. 14, Series in Experimental Biology, Vol 3. Cloth. Price, 38.50 Swiss francs; Paper, 34.50 Swiss francs. Pp. 354, with 132 illustrations and 3 color plates. Basel: Verlag Birkhäuser, 1946.

This book, in the German language, presents some entirely new viewpoints in the physiology of nerve. The author is chairman of the Department of Physiology at the University of Berne and created considerable attention at the International Congress of Physiology in 1938 by an ingenious and novel method to collect the chemical products associated with nerve activity. During the war years, the author has elaborated his methods and has designed many original ones of his own. The most ingenious of these is probably a method for instantaneous polarography which in itself would be a major contribution. Other new methods have been developed by the author and old methods have been improved on. The book gives a description of most of these. With his own newly developed technic and with the standard technics known to neurophysiologists, such as acetylcholine determinations and action current recording, the author has set out to study the problem of nerve conduction, or, as he calls it, signal transmission along a nerve. He contributes to this field many original and extremely fresh ideas. The author divides the signals which are transmitted along the nerve into internal signals and external signals. By internal signals he means those that are responsible for the maintenance of function of the nerve, while by external signals he means the normal nerve impulse. His studies on the internal signal have led him into much work in nerve regeneration and degeneration. There is an excellent discussion of much of the work done in the field of nerve regeneration to which original work has been added. Isolation of a growth substance which has a strong regenerative effect is described. In his work on transmission of the external signals which is more commonly known as impulse transmission in the nerve, the author proposes a theory, of which he is well aware that final proof is not complete. The theory is basically as follows: Rather than a longitudinal nerve membrane, the author assumes transverse membranes in the nerve. These membranes are to be found at the Ranvier nodes and the section between the Ranvier nodes is to be considered as a unit of neural function. One is then dealing with an impulse which, rather than being conducted continuously, is discontinuously conducted from Ranvier node to Ranvier node. Neither of these ideas is new nor does the author claim that they are. The discontinuous transmission has been suggested by Erlanger years ago. The transverse membranes have been suggested by Nernst and many others. The challenging part of the author's study is the evidence and theoretical deductions that he brings forth to prove his viewpoints. The author himself is thoroughly aware of the need for further confirmation of his hypotheses and stresses this all through the text. There is a wealth of references to the literature and American literature has been taken into consideration as well as European literature. This book is an extremely important contribution to our physiologic understanding of nervous function. It should be read and studied by everybody interested in the physiology of peripheral nerves.

THE AMERICAN HOSPITAL. By *E. H. L. Corwin,* Ph.D., Executive Secretary, Committee on Public Health Relations, the New York Academy of Medicine; Honorary Charter Fellow of the American College of Hospital Administrators; Former Secretary General and Honorary President of the International Hospital Association. Cloth. Price, $1.50. Pp. 213. New York: The Commonwealth Fund, 1946.

The reading of this book shows the many changes the American hospitals have undergone during their history with the greatest development and evolution as an American institution during the past thirty or forty years. Its concept and usefulness have been altered by numerous factors which often are not recognized by physicians and other personnel who are intimately associated with the hospitals. They are perhaps too closely attached to them to realize the changing order of the modern hospital and the problems that generally confront the hospitals. Alterations in medical practices, distributions of wealth and growth of urban population at the expense of rural population are a few of the more important factors that have particularly affected the hospital.

Figures concerning finances should be surprising and instructive to most physicians; for example, in New York City the cost per bed in a large hospital built less than twenty years ago was $18,000.00. The funds supplied by the local, state or national government in 1927 amounted to 28.5 per cent of the capital funds whereas by 1937 this had increased to 71.5 per cent. The plant assets now total the large sum of five and one-half billion dollars and with a yearly operating cost of about one and one-half billion dollars hospital service is one of the major industries of the United States. Many other items are brought out.

The future means of obtaining hospital income is considered in the chapter on hospital finances and merits serious thought on the part of the profession. As is shown the time is past when a few philanthropic and wealthy persons can be relied on to supply the money for the erection and maintenance of a hospital. This also applies to resources that are now available by such groups as the Commonwealth Fund, the Duke Foundation and others. The money supplied by fees is grossly inadequate to run a good hospital. Is it to be more and more federal capital or tax funds raised by local communities? Can the smaller town or rural areas assume such a responsibility? It would certainly be costly. The author discusses the number and type of hospital in these smaller communities and cites as one of the reasons why well trained physicians often do not wish to practice in such areas is the lack of proper hospital facilities. The author makes no attempt to give the answers for the solution of the problems but the discussion is stimulating and important not only to the general public but more so to the medical profession.

The chapter on the Out Patient Department shows the trend and changes that have occurred. He points out the indifference and neglect that is present too often, the lack of supervised teaching facilities, the manner of appointment of the professional staff, the need for compensation for the physicians and other aspects. He aptly calls this department the "Cinderella of the medical household."

Numerous references are made to the departments of physical medicine. It may interest physiatrists to know that in the various hospitalization contracts, 42 per cent of the plans in forty-three states provide physical therapy as a part of the service. The author's understanding and appreciation of physical medicine shows the change from the past. No longer is it necessary to make a plea for such a department or to justify its existence; it is now taken for granted that it is a part of any modern hospital.

The last chapter entitled "Retrospect and Prospect" is worth reading. The author expresses the defects of the American hospital in these sentences: "It has not adjusted itself adequately to the income levels of all groups of people or the needs of all geographic areas. It has not uniformly reached the level of excellence it is potentially capable of achieving. It still lacks insight to sense its inherent possibilities and the means of bringing them to realization." However, he is not discouraged for he believes the faults are not beyond correction and this last section of the book expresses optimism and it closes with the expression "Hospital horizons are expanding."

From the title of the book it might be assumed that its appeal would be primarily to hospital administrators. Certainly they will profitably find much to help them but its reading should be more general. Civic minded lay persons should find much information here and, of course, all physicians will be interested in the facts and the discussion of a few of the more fundamental problems of American hospitals. The author's presentation is clear and authoritative and sufficient statistical material is given to be convincing without becoming monotonous. The Commonwealth Fund is to be commended for publishing these excellent and timely monographs. They are rendering a laudable service.

DISEASES OF THE NOSE AND THROAT. By *Charles J. Imperatori,* M.D., F.A.C.S., Consulting Laryngologist, Harlem Hospital, New York and Nyack General Hospital, Nyack, N. Y.; Consulting Bronchoscopist, Manhattan Eye, Ear and Throat Hospital, N. Y.; Flower and Fifth Avenue Hospitals, New York, and Riker's Island Hospital, New York; Formerly Professor Clinical Otolaryngology, New York University and New York Post Graduate Medical School, Columbia University; Professor of Otolaryngology, New York Polyclinic Medical School and Hospital; Surgeon (Otolaryngology), Bellevue Hospital, New York; and *Herman J. Burman,* M.D., F.A.C.S., Director of Department of Otolaryngology, Harlem Hospital, New York, Instructor in Otolaryngology, College of Physicians and Surgeons, Columbia University, New York; Assisting Visiting Otolaryngologist, Presbyterian Hospital and Vanderbilt Clinic, New York; Formerly Assistant Professor, Clinical Otolaryngology, New York Post Graduate Medical School, Columbia University; Adjunct Professor of Otolaryngology, New York Polyclinic Medical School and Hospital; Consulting Bronchoscopist, Broad Street Hospital and Pan American Clinics, New York. Third Edition. Cloth. Pp. 576, 480 illustrations. Price, $12.00. Philadelphia, London,. Montreal: J. B. Lippincott Co., 1947.

The third edition of this popular text reflects the recent advances in surgery and therapy in the field of otolaryngology. Recent studies in the pathology of the nose have altered ideas on the type of medication to be used and the methods of administration. Surgery is now performed not merely to remove pathology or deformity but to secure optimum postoperative functional results. A section on vitamin deficiencies has been added, to cover the oral manifestations of nutritional disturbances. Reference is made in the chapter on sinusitis that because of the strides in chemotherapy, complications of nasal conditions are less frequent. The chapter on radiation therapy has been revised. The comprehensive and well illustrated chapter on physical therapy and radiation has been evidently left unchanged since the earlier edition. Contrary to the present well established consensus of opinion, the authors seem still to be impressed greatly by the alleged special effects of ultrashort waves. They also describe zinc ion transfer of the nose in great detail, only to add at the end of a full page, that experimental work shows that this procedure is of doubtful value. The clarity of the text is enhanced by the numerous excellent illustrations, including those of microscopic anatomy, and graphic anatomical drawings. This is indeed a practical and dependable book by two outstanding clinicians suitable for specialists as well as for general practitioners.

GYNECOLOGICAL AND OBSTETRICAL PATHOLOGY, WITH CLINICAL AND ENDOCRINE RELATIONS. By *Emil Novak,* A.B., M.D., Sc. (Hon. Dublin), F.A.C.S., Associate in Gynecology, The Johns Hopkins Medical School; Gynecologist, Bon Secours and St. Agnes Hospitals, Baltimore; Fellow, American Gynecological Society, American Association of Obstetricians, Gynecologists and Abdominal Surgeons and Southern Surgical Association; Honorary Fellow, Societe Francaise de Gynecologie; The Royal Institute of Medicine, Budapest; Sociedad d'Obstetricia et Gynecologia de Buenos Aires; Central Association of Obstetricians and Gynecologists; Past Chairman, Section of Obstetricians and Gynecologists; Past Chairman, Section on Gynecology and Obstetrics, American Medical Association. Second Edition. Cloth. Price, $7.50. Pp. 517 with 542 illustrations, 15 in color. Philadelphia and London, 1947.

Novak's book offers students and physicians the fundamental histologic and pathologic knowledge of gynecology. The pathologic features of the different gynecologic conditions are extensively described and thoroughly discussed, offering the rich experience of the author. Thirty-four chapters of the volume take up the subject in anatomical order, beginning with diseases of the vulva. The endocrine phase is extensively presented. References are given at the end of each major chapter, and the book is well indexed. Dr. L. M. Hellman contributed a chapter of Abnormalities and Diseases of the Placenta and Appendages. The material is presented in clear style. The illustrations are excellent. This book is highly recommended.

RENAL DISEASES. By *A. T. Bell,* M.D., Professor of Pathology in the University of Minnesota, Minneapolis, Minnesota. Illustrated with 115 engravings and 4 color plates. Pp. 434. Price, $7.00. Philadelphia: Lea & Febiger, 1947.

The purpose of this monograph is to present the pathology of the various renal diseases and the features by which they may be recognized clinically and at postmortem. The pathologic physiology is discussed with each disease since the type of functional disturbance is usually closely related to the underlying structural alterations in the kidneys. Much of the volume is a compilation of studies on renal diseases carried on by the author during the past twenty-five years. The rationale of treatment is presented but the reader is referred to special papers for the details of therapy. The relation of hypertension to the kidneys is discussed fully, and there is a discussion of the toxemias of pregnancy and the renal lesions in diabetes. In the exposition of each renal disease an effort is made to correlate the structural changes with the clinical manifestations. The illustrations are ample. The author states that the literature of renal disease is now so voluminous that one can survey only the more important contributions and indicate the stages through which our thinking has progressed; he offers valuable guidance along these lines and also cites abundant references for those desiring more complete information. This is an authoritative and well written monograph, which should greatly promote cooperation of clinicians and pathologists in one of the most important fields of medicine.

BUCHANAN'S MANUAL OF ANATOMY. Edited by *F. Wood Jones,* D.Sc. (Lond., Adelaide and Melb.), M.Sc. (Manch.), M.B., B.S. (Lond.), F.R.S., F.R.C.S., Eng.; Sir William Collins, Professor of Human and Comparative Anatomy at the Royal College of Surgeons of England: sometime Professor of Anatomy in the University of Manchester. Seventh edition. Cloth. Price, $10.00. Pp. 1616. Baltimore: The Williams & Wilkins Company, 1946.

This is recommended as a standard text in anatomy for use of the medical student during his course in dissection. Its popularity is attested to by the fact that this is the seventh edition which has appeared since 1906. A distinctive feature of the book are the excellent drawings reproduced from the originals from the early editions and a new addition to the present volume is the inclusion of a series of x-ray plates which are helpful particularly as the development of bones during childhood is illustrated. The glossary which is appended is of considerable value to the young medical student. No special attempt is made to describe or illustrate the functional action of muscles, but otherwise this is a thoroughly satisfactory textbook of anatomy.

ANATOMY AND PHYSIOLOGY FOR STUDENTS OF PHYSIOTHERAPY, OCCUPATIONAL THERAPY AND GYMNASTICS. By *C. F. V. Smout,* M.D., M.R.C.S., L.R.C.P., Assistant Professor of Anatomy, University of Birmingham; Examiner to the Chartered Society of Physiotherapy; and *R. J. S. McDowall,* M.D., D.Sc., Professor of Physiology, University of London, King's College. Second edition. Cloth. Pp. 470. Price, $8.00. Baltimore: The Williams & Wilkins Company, 1946.

The appearance of the second edition of this book emphasizes the need for basic science text books written specifically for physical therapy students. At present the student in this field is obliged to use texts written for nurses or medical students in which the emphasis is not always appropriate for the physical therapist.

About two-thirds of the book is concerned with human anatomy. The emphasis on the musculoskeletal and peripheral nervous system is well placed. The anatomy section contains description of both gross and microscopic structure; it is well written and abundantly illustrated. Especially valuable are the chapters "Levers and Leverage" and "Muscles in Action." These chapters give the physical therapy student an interesting introduction to kinesiology.

The portion of the text devoted to physiology does not cover the subject matter with the completeness that this reviewer would desire for students of physical therapy. It may well be that in

England the knowledge of this subject is not considered as necessary for the therapist as we believe in this country. Today, however, when so many of our students of physical therapy are undergraduate or graduate college students, the teaching level in the basic sciences should be appropriately high. To cover the field of both anatomy and physiology adequately in a volume of this size is perhaps not possible.

In general, the book can be recommended as an anatomy text for students of physical therapy, and with supplementary reading might serve as a guide for the teaching of physiology.

PEAT THERAPY IN HOSPITALS OF FRONT LINE AND ARMY DISTRICTS. By *G. L. Magazanik.* Daugavpilsky Printing Shop. V. A. P. P. No. 11, 1945. Pp. 40. Paper, 1945. (In Russian.)

This little brochure represents a brief and concise description of that type of mud therapy in which peat is used. The author discusses: (1) the origin and different kinds of peat and their physical and morphological characteristics, (2) selection of the proper kind of peat for therapeutic purposes, (3) therapeutic methods, (4) explanation of the therapeutic effects of peat application, (5) the place of mud therapy in medicine (6) indications and contraindications for mud therapy.

There is no doubt that after reading this excellent brochure, anyone wishing to use peat therapy can do so. Although beneficial results may be obtained with peat therapy, one can not escape a conclusion that this messy type of treatment should be resorted to only under primitive conditions when other methods are lacking.

THE PRINCIPLES AND PRACTICE OF TROPICAL MEDICINE. By *L. Everard Napier,* Companion of the Order of the Indian Empire; Fellow of the Royal College of Physicians of London; Formerly Director and Professor of Tropical Medicine, Calcutta School of Tropical Medicine; Consultant to the Secretary of War; Visiting Lecturer on Tropical Medicine, Army Medical School; Visiting Lecturer on Tropical Medicine, Harvard Medical School, Boston; Formerly Visiting Professor of Tropical Medicine, Tulane University, New Orleans; Formerly Visiting Professor of Medicine, New York University; Fellow of the Royal College of Physicians of London; Formerly Director and Professor of Tropical Medicine, Calcutta School of Tropical Medicine; Visiting Lecturer on Tropical Medicine, Harvard Medical School, Boston. First edition. Cloth. Price, $11.00. Pp. 917, with 195 illustrations. New York: The Macmillan Company, 1946.

The author points out that this is primarily a textbook for the student, practitioner and public health worker. He emphasizes the great importance of thorough knowledge of the etiology and mode of transmission in treatment and prevention of most tropical diseases as contrasted with diseases of temperate climates. Subjects are presented from the British point of view. Diseases such as malaria, kala-azar and trypanosomiasis are completely covered.

The general appearance of the book is good, but some pages seem overcrowded. Occasionally printing shows through from the reverse sides of pages due to poor quality of the paper. Most illustrations are good but many are too small to be effective.

SPEECH AND HUMAN RELATIONS. By *Joseph G. Brin,* Director of the Office of Speech Counseling, Boston University. Cloth. Pp. 166. Price, $2.50. Boston: Bruce Humphries, 1946.

The reviewer has long believed that university teachers should be forcibly educated in public speaking if they are not already well trained. It is a grievous spectacle to observe a man highly thought of in his field and with a message to impart, stand lost in embarrassment while his audience begins to yawn or scrape its feet. If it is rational to believe that every other activity—music, sports, brick-laying—requires training to do well, then surely public speaking should be included. The monotonist, the teeterer, the fumbler with pocket change, the speaker who stares out the window, at the ceiling, or at his shoes—are often unaware of these defects. A few sessions with a speech consultant and reading Mr. Brin's book will do wonders.

The ideal is easily stated but requires discipline and practice to realize: speak conversationally, as though to two or three friends. But organize your ideas better, raise your voice a little louder, than in a casual conversation. Above all, maintain an interchange of intelligence between you and your hearers by looking at them individually and noting their response to you.

Mr. Brin's excellent book can be read in an evening and well repays the effort.

PSYCHOTHERAPY IN GENERAL MEDICINE. By *Geddes Smith,* Associate, The Commonwealth Fund. First Edition. Price, 25c. Pp. 38. The Commonwealth Fund, 1946.

This is the report of an experimental two weeks course given at the University of Minnesota during April, 1946. It was organized in an initial effort to counteract a tendency which has troubled thoughtful medical educators for some time, the overswing of the pendulum, in medical schools and medical practice generally, toward what might be called organ diagnosis and fractional therapy and away from the art of medicine which encompasses the whole man. The planners of this course sought answers to three pertinent questions. Can doctors be taught to practice in their own offices the kind of medicine psychoneurotic patients need? Can they learn to use in all their practice the gist of what modern psychiatry has to say about human personality and the way it works? Can they get some idea of what comprehensive medicine means? The course, conducted by experienced psychiatrists consisted of morning lectures and afternoon seminars; as it progressed it showed the ineptness of many of the students

in their first contacts with patients and the rigidity of their diagnostic approach, reflecting a lack of their professional training. Many good medical schools have failed to teach the art of medicine. At the end of the course, it became evident that men in general practice could learn readily and quite a great deal about ways to help psychoneurotic patients. In retrospect the specific goals of this experimental course were summed up as follows. To give the doctor a feeling of the dynamic qualities and the value of the doctor-patient relationship; to introduce him to broad patterns of human motivation and to the common causes and backgrounds of emotional disturbance; to lead him to think in terms of the relation between emotional disturbance and illness; to teach him easily understandable methods of therapy so he can treat a share of such illness, and finally, to give him some knowledge of malignant conditions so that he may refer them to specialists. It seemed to the instructors that the course offered good evidence that psychotherapeutic medicine can and should be part of the postgraduate medical education wherever serious students, skillful teachers and clinical material can be brought together.

ADJUSTMENT TO PHYSICAL HANDICAP AND ILLNESS: A Survey of the Social Psychology of Physique and Disability. By *Roger G. Barker, Beatrice A. Wright* and *Mollie R. Gonick.* Paper. Price, $2.00. Pp. 355. New York: Social Science Research Council, 1946.

This is a review of several hundred studies concerning adjustment to physical handicap and illness. Chapters are devoted to the subjects of orthopedic crippling, tuberculosis, impaired hearing, acute illness and the employment of the disabled. The opening chapter deals with somatopsychologic aspects of normal variations with the work of several investigators considered on such problems as behavior of tall and short persons, obese children, sensitivity to physical characteristics and others. The bibliography is complete, consuming a total of fifty-two pages.

Occupational therapy is singled out with two pages and the following quotation will not particularly please the occupational therapists, "the chief weakness of the occupational therapy movement is its failure to develop an adequate rationale for its program. It has offered neither objective proof of its effectiveness nor a theoretical basis for its procedures."

The work shows what is being attempted in a psychologic approach to diseases and disorders. The authors admit that many of the reports are conflicting with which this reviewer would heartily agree. It is often very difficult to distinguish the wheat from the chaff. The authors could have consolidated much of the material and for clarity and a better appreciation they might have included more of their own opinions.

It is unfortunate that the purpose of the book as set forth in the preface, to bring out "the relations between social behavior and personality and abnormal and pathological variations in physical size, strength, motorability, sensory acuity and health," was not achieved. Surely the medical men sorely need any knowledge and guidance from the association of physique and personality or the effects of disabilities on behavior. This is a new field and only a beginning has been made in a scientific approach to the problem. The authors demonstrate the difficulties in evaluating the work that has been done.

A HANDBOOK OF OCULAR THERAPEUTICS. By *Sanford R. Gifford,* M.A., M.D., F.A.C.S., Late Professor of Ophthalmology, Northwestern University Medical School. Revised by *Derrick Vail,* M.D., D.O. (Oxon), F.A.C.S., Professor of Ophthalmology, Northwestern University Medical School, Chicago, Ill. Fourth Edition. Pp. 336, with 66 illustrations. Price, $5.00. Philadelphia: Lea & Febiger, 1947.

The fourth edition of this useful work appears at a revolutionary period in the therapeutic approach to ocular diseases. Since the previous edition was published new therapeutic agents have almost entirely eliminated the older ones. This new edition reflects all these radical changes. There is a complete chapter on the use of physical medicine in ocular therapeutics.

Not too much of the new has been added to the work to detract from the personal touch which lifted the work out of the ordinary. This edition gives a concise, authoritative and thoroughly modern guide to treatment of ocular disease. This is a thorough revision and the information has been brought up to date and the material on new remedies and new methods of treatment is absolutely authoritative. It should be in the library of every physician treating ocular diseases.

FATIGUE AND IMPAIRMENT IN MAN. By *S. Howard Bartley,* Ph.D., Professor of Research in the Visual Sciences, Dartmouth Eye Institute, Dartmouth Medical School, and *Eloise Chute,* M.A., Research Associate in the Visual Sciences, Dartmouth Eye Institute, Dartmouth Medical School. Foreward by *A. C. Ivy,* Ph.D., M.D., Vice-President, Chicago Professional Colleges, University of Illinois. First edition. Cloth. Price, $5.50. Pp. 429, with 60 illustrations. New York and London: McGraw-Hill Book Company, Inc., 1947.

This unusual book, written by a physiologist with a wide experience in different fields of physiology, tries to treat the subject of fatigue and impairment in its entirety. The author has covered many contributory fields and analyzed the data pertaining to fatigue and impairment problems. Electrophysiological studies, studies on anoxia, studies on carbohydrate metabolism and general metabolism studies are included. The author also discusses drug action in relation to fatigue and impairment and such subjects as organization in neuromuscular activity, sleep and other periodicities, mental and visual fatigue, and a number of other problems which are of considerable impor-

tance to the general problem of fatigue and impairment.

This book contains a wealth of information and numerous references to the literature. Much of the literature on fatigue and impairment is recent, that is, has occurred within the last quarter century, and much of it has to be looked for in widely different journals. The author has done a very good job of getting this scattered literature together and analyzing and coordinating it. Many of the problems in fatigue and impairment are still highly controversial. Many others are still to be considered unsolved. Another author might well have analyzed the available material in a different way and sometimes even might have come to conclusions different from the present author. This is only natural in a subject where our knowledge is as scattered and incomplete as in this particular field. There is no better way, however, to obtain further progress in a certain field than to collect, analyze, and coordinate the material so far available. All in all, this book is an extremely important publication which should, and undobtedly will be, a challenge to further work in this field and a considerable contribution to getting this work underway.

PREOPERATIVE AND POSTOPERATIVE CARE. By *William J. Tourish,* M.D., F.A.C.S., Demonstrator of Surgery and Chief Clinical Assistant in Surgery, Jefferson Medical College and Hospital; and *Frederick B. Wagner,* Jr., M.D., Instructor in Surgery and Assistant in Surgery, former Resident, and *Ross V. Patterson,* Fellow in Surgery, Jefferson Medical College and Hospital. Foreword by Thomas A. Shallow, M.D. Pp. 350, with 87 Illustrations. Price, $6.00. Philadelphia: F. A. Davis Company, Publishers, 1914-16 Cherry Street, Philadelphia 3, Pa., 1947.

The tremendous progress in knowledge of the proper care of patients before and after surgical procedure has enabled surgeons to undertake operations formerly considered unduly formidable, to work with relative safety in practically any part of the body, and to include patients of any age. Despite the fact that a fundamental understanding of these general measures allows intelligent application to specific operations, experience has shown that almost every major procedure has its key preoperative needs and its characteristic postoperative complications. The methods of preoperative and postoperative care described and illustrated in this book represent the general policy and procedures throughout the large clinics of the country as well as in the surgical department at the Jefferson Hospital. The general principles of preoperative and postoperative care and their application in actual practice are first outlined so that the specific procedures which follow have a rational basis. The postoperative complications are grouped as immediate, early and late. Preoperative and postoperative care in certain of the surgical specialties have been contributed by outstanding authorities. Although primarily for the intern and the senior medical student, this book should serve also as a most useful reference guide for the general practitioner, informing him of the improved procedures that are practiced today.

MEDICINE IN THE CHANGING ORDER. Report of the New York Academy of Medicine Committee on Medicine and the Changing Order. Pp. 240. Price, $2.00. New York: The Commonwealth Fund, 1947.

The New York Academy of Medicine in 1942 established the Committee on Medicine and the Changing Order with the following objectives: "To explore the possibilities and to formulate methods of maintaining and improving standards of quality in medical service, including medical research, medical education, the maintenance of health, both physical and mental, the prevention of disease, and the treatment of disease; to study the means of making available to larger groups of people and to the country as a whole the best known practice in preventive and curative medicine; to explore the possibilities and to formulate proposals of distributing these services not only to a larger number but also at a lower per capita cost than the present system permits." The 48 committee members, laymen and experts from the fields of medicine, dentistry, nursing, have examined every phase of the current medical situation including medical education, nursing service, dental care, public health service, hospital facilities and medical research, seeking answer to these fundamental questions: How can medical service be bettered? How do the economic and social changes now taking place affect it? The report in this volume draws together the findings of the committee's study and its thoughtful conclusions can be epitomized as follows: "In extending medcal service and perfecting its organization, quality must be preserved; Provision of public health services is a prime essential; Improvement in medical service requires effective use of hospitals with adequate facilities; Success will require trained professional and non-professional personnel; For optional results organization and cooperation of physicians are required; In the improvement of medical services, voluntary prepayment plans are needed; The goal should be comprehensive medical service; Extensive education for both physicians and the public will be required; Progress in the extension of medical service must be varied and adapted in each instance to the needs of the community; Government aid will be required." The committee recognizes the futility of viewing medical care as an isolated phenomenon. Not one problem but a multiplicity of problems exist and each varies with geographic, social, economic and educational circumstances. No single line of action can serve as the solution and no panacea is offered, but a great many far-reaching recommendations have been made which command the attention of every thinking person interested in the health of the nation and the future of American medicine. Viewed from this standpoint this volume will be found to be absorbing literature.

PHYSICAL MEDICINE ABSTRACTS

Recovery of Stretch Reflexes After Nerve Injury. D. Barker, and J. Z. Young.

Lancet 6456:704 (May 24) 1947.

In spite of the large amount of published work on the regeneration of nerve very little is known of the recovery of proprioceptor function. Since the functions of the various receptors of muscle in normal life are still largely unknown, it is impossible to estimate the importance of their recovery after nerve lesions, but it seems likely that some of the imperfections of muscle function after nerve suture are due to incomplete sensory reinnervation.

The extent of movement of the leg in the knee-jerk is not a linear function of the tension developed in the quadriceps muscles. Considerable tension must be developed before any movement can take place. Therefore, when the muscles are reinnervated after nerve injury, a recovery of 50 per cent may be insufficient to produce any visible knee-jerk.

If two of the three branches of the crural nerve of the rabbit are interrupted, that part of the quadriceps which remains intact is just able to overcome this "inertia factor" and produce a small knee-jerk. Hypertrophy of the intact part of the muscle may then lead to a considerable increase of this residual jerk.

When two of the three crural branches are interrupted by crushing with smooth forceps, the knee-jerk fully recovers. Indeed, the recovered response may be temporarily supernormal because of a hypertrophy of the intact muscles.

When the whole crural nerve is crushed, there is full recovery of the knee-jerk without a supernormal phase.

When two of the three branches were severed and reunited, five animals showed no visible recovery of the knee-jerk, whereas eight showed a recovery of 19-70 per cent. The recovery reaches a maximum soon after nerve-fibers have returned to the muscles, and does not increase progressively thereafter.

When the entire crural nerve was cut and reunited, the recovery remained undetectable in nine cases, but in two others slight knee-jerks reappeared, indicating development of over 50 per cent of normal tension.

Electromyography in Clinical Medicine. P. Bauwens.

Brit. J. Phys. Med. 10:75 (May-June) 1947.

In electromyography, as the term implies, it is primarily the muscular tissue which is the object of examinatoin. Nevertheless, it is indirectly to neurology that it affords its greatest diagnostic assistance.

The simplest means of picking up action potentials consists in placing two electrodes in direct contact with the tissues under examination. In a physiological laboratory this presents no difficulty. Clinically, in order to record action potentials, recourse must be had either (1) to needle electrodes introduced right into the tissue or (2) to the percutaneous method. In spite of the disadvantage of repeated punctures, the former procedure is the method of choice.

When the concentric electrode described above is introduced into the muscle, action potentials, due to the contractions provoked by the mechanical irritation of the moving needle, are registered. Once the needle is in place (provided that it is in part of a muscle at rest) no electrical phenomena are in evidence. If, however, the muscle is in action, even partially, monophasic or diphasic action potentials are recorded. When derived from a normal muscle, these potentials produce in the loudspeaker rather dull sounds vaguely reminiscent of a muffled drum-roll.

Studies of Thermal Injury. VI. Hyperpotassemia Caused by Cutaneous Exposure to Excessive Heat. R. McLean; A. R. Moritz, and A. Roos.

J. Clin. Investigation 26:497 (May) 1947.

That the rapid release of potassium from erythrocytes during an episode of generalized cutaneous hyperthermia may cause an increase in plasma potassium sufficient to contribute to the occurrence of circulatory failure and death was suggested by Schjerning in 1884. The suggestion was based in part on the fact that postmortem examination of extensively burned persons often disclosed evidence of severe intravascular hemolysis and in part on the fact that a sufficient amount of potassium may be released from erythrocytes in vitro to raise the plasma concentration of that element to a level incompatible with continued cardiac function.

In a foregoing study in this series, it was observed that generalized cutaneous exposure to excessive heat may lead to rapidly fatal circulatory failure. In several pigs that died in this manner and whose deaths were preceded by electrocardiographic evidence of severe disturbance in cardiac function, the plasma potassium was found to be increased to levels ordinarily considered incompatible with life. The implication of this observation was such as to warrant further study of the effects of hyperthermia on the potassium concentration of the plasma.

The experiments have established that severe and extensive cutaneous burning may result in a rapid rise in plasma potassium to levels ordinarily considered incompatible with life. Such levels are attained when a large proportion of the body

surface of an animal whose erythrocytes normally have a high potassium content is maintained at temperatures as high as 75 degrees C. for more than a few minutes. That lower surface temperatures may also be responsible for fatal hyperpotassemia is suggested by the fact that potassium may be released rapidly from blood cells in vitro at temperatures of 60 degrees C. Because of the slowness with which potassium is released at lower temperatures and the rapidity with which excess potassium leaves the blood stream, it is not likely that thermal exposures of insufficient intensity to cause severe cutaneous burning could cause sufficient damage to the erythrocytes to produce dangerously high plasma levels.

Backache. B. H. Burns, and R. H. Young.

Lancet **6454**:623 (May 10) 1947.

It is not necessary to operate on a high proportion of patients with backache alone. The alternatives are rest in bed, or modified rest by wearing a corset. There is little advantage in wearing a plaster cast, since it is more cumbersome and less comfortable than a corset, which is as efficient in restricting movements at the lumbosacral junction. Other forms of physical treatment, such as radiant heat, diathermy, and infra-red rays, do give temporary ease by diminishing the muscle spasm, but their effect is not lasting.

The authors used to practice manipulation of low backache. Here also the effect was disappointing in our hands, and we rarely do it now. Sometimes it was dramatically effective, probably because it allowed the protruded part to return to its proper place, or shifted the root off the protruded disk. But not infrequently the patient was made worse, and sometimes the patient with sciatica will say that he only had backache before the manipulation, but after it he developed sciatica.

The Place of Health Resort Therapy in Dermatologic Disorders. Anthony C. Cipollaro.

J. A. M. A. **134**:249 (May 17) 1947.

It is worth while to emphasize the fact that a hotel at the seashore or at the mountains, equipped with hydrotherapy apparatus and a solarium, is not a health resort and is useless for the treatment of cutaneous diseases. The comprehensive, supervised regimen, supplemented by specialized treatments as described, can be undertaken only at an establishment designed and equipped solely for therapeutic purposes.

It is important to mention radium waters. The efficacy of radium waters has never been proved. Bathing in waters which contain therapeutically effective quantities of radioactive substances is dangerous, and drinking them is even more to be condemned. Radioactive substances absorbed through the skin or taken internally, even in minute doses, have a cumulative effect which can cause degenerative changes and even death.

Patients suffering from diseases of the skin are as a rule ambulatory and can avail themselves fully of the natural advantages, general regimen and specialized treatments available at the well equipped spa.

Natural waters alone are not adequate for the treatment of cutaneous disorders. Spring waters coupled with a health resort regimen and adequate medical services are of inestimable value.

It is necessary to add to the health resort regimen the services of a qualified dermatologist and the facilities required for the treatment of cutaneous diseases. There are a number of diseases of the skin which should prove amenable to treatment at an approved spa. It is the belief of the author that most patients with these diseases will derive immense benefit from proper treatment at a health resort.

Early Postoperative Ambulation. F. H. Estes.

J. M. A. Georgia **36**:200 (May) 1947.

Early ambulation as a method of postoperative surgical management is gaining wide recognition. It seems to carry no more danger of wound disruption and postoperative hernia than the conventional method of prolonged bed rest. The incidence of atelectasis and pneumonia is markedly reduced. Thrombosis and embolism are reduced in frequency. There is a striking improvement in the general appearance of the patient with this method of treatment. Hospital stay is reduced, with a subsequent reduction in expense. The contraindications to early ambulation are few in number.

Effects of Galvanic Stimulation on Limb Volume in Nerve Injuries. James E. Bateman.

Canad. M. A. J. **56**:627 (June) 1947.

The aim of reconstruction in extremities with peripheral nerve injuries is maximum function of the part. While much attention has been paid to the diagnosis of nerve injuries and to the technic of suture, the care of the muscle on the other hand has been relatively neglected. Some of this neglect arises from the lack of an accurate physiologic explanation of the atrophy which occurs following denervation. The process of atrophy begins a few days following nerve section and leads to severe damage of the contractile muscle elements. The atrophy increases, is accompanied by degeneration and followed by infiltration of fibrous tissue.

Opinions regarding the value of electrical stimulation have long been in conflict, but during the recent war, strong experimental evidence in favour of electrical exercise has been introduced by several workers. The results of these carefully controlled experiments in animals indicate: the atrophy of denervation may be decreased by electrical stimulation; the effectiveness of electrical stimulation varies directly as the number of treatments within the fatigue level; the electrical stimulation accelerates the return to normal volume after reinnervation has begun; less fibrosis, larger muscle bundles, more definite striation is apparent microscopically following arequate galvanic stimulation.

Adequate continued galvanic stimulation of denervated muscle produces measurable increase in limb volume. This corroborates previous experimental results in animals. The changes are such that careful volumetric examination is necessary for demonstration. Improvement from electrotherapy is greatest in the early period after nerve suture. The improvement which may be expected from electrical stimulation is roughly comparable to the difference seen between normal right and left arms. Not all nerve sutures will maintain a positive balance even with adequate electrical stimulation but increasing atrophy may be prevented in 93 per cent of nerve sutures.

It is felt that the average consistent volumetric improvement following electrical stimulation as compared with the average consistent loss without treatment is a sound basis for continued use of adequate galvanic stimulation.

Treatment of Intestinal Conditions as Based on Disordered Function. Donovan C. Brown; Gordon McHardy, and George Welch.

J. A. M. A. **134**:230 (May 17) 1947.

The authors cannot establish an indication for therapeutic enemas and irrigation of the colon in the management of psychogenic colonic dysfunction.

Physical therapy, including simple massage, exercises (passive and active), hot packs and diathermy have both a general and a specific application. Often simple measures such as contrast showers and warm tub baths do much to relax the tense patient.

Occupational therapy coupled with an effort at social and economic adjustment may call for more than passing consideration in aiding the patient to outline a useful constructive program of living.

Physical Medicine in the Care of Rheumatoid Arthritis. Howard F. Polley.

South. M. J. **40**:596 (July) 1947.

Daily treatment in the home is an advantageous supplement to professional treatment. The luminous source of radiation is richer in the slightly more penetrating infra-red rays than are resistance coils or other nonluminous sources of radiation. Hot paraffin or hot fomentations are other simple and effective means of applying heat locally to the back or extremities.

Fever therapy is customarily not used or is used in a milder degree for patients who show evidences of senility or are markedly debilitated by the rheumatoid arthritis or some other noncomitant condition. Mild fevers by means of hydrotherapy alternated with luminous bakers and other means of producing local or general heating in the home provide the basis for a sound, practical and efficient physical treatment program. Patients should be cautioned that poor or even harmful results may obtain if massage is given too heavily, too vigorously or too roughly.

Therapeutic exercise is valuable in preventing deformity and ankylosis of the joints. It also helps to increase circulation, muscular strength and general metabolism. A regular program of exercise for uninvolved as well as involved joints often helps to shorten convalescence when activity is resumed.

In addition to exercise administered under the guidance of the physician and technician, the patient may be advised to repeat the exercises in his home at least several times daily, thus increasing the effectiveness of the physical treatment. When the patient is able to carry out active therapeutic exercise he should be expected to assume a large share of the responsibility for prevention of deformities or for their correction if they are already present.

In most instances, the patient should have ten to twelve hours of rest in bed during each twenty-four hours. This should be continued even after the disease becomes quiescent. More hours of rest or complete rest in bed may be indicated in the presence of fever, marked debility, progressive loss of weight or progression of the active stages of the arthritis. The bed should have a firm, nonsagging mattress and springs. The patient should be in a position favorable to correct bodily mechanics. The use of pillows under the knees should be avoided. Adequate rest can be correlated advantageously with carefully prescribed exercises and other physical treatment.

The Obese Patient. Henry M. Ray.

Am. J. Digest. Dis. & Nutrition **14**:153 (May) 1947.

The matter of exercise which is so important for increasing energy output is a very individual matter. Many of the obese patients, obese for years, have already reached the limit of their cardiac reserve and especially in the hypertensives with cardiovascular disease, exercise is contraindicated. These patients get sufficient exercise in their daily work and must compensate for their necessary limitation of physical activity and lessened energy output, by a stricter diet, in order adequately to curtail the energy intake. There is no objection to passive exercise and massage. The advertised gymnastic emporia while safe for the younger and relatively healthy obese, is a menace to the middle-aged group, particularly those with cardiovascular strain and degenerative musculoskeletal and arthritic disease.

Rest Versus Activity in the Treatment of Fractures

For. Letters, J. A. M. A. **134**:204 (May 10) 1947.

In a presidential address to the Orthopedic Association Mr. George Perkins stated that the enormous advantages to be derived from activity of a fractured limb are not sufficiently recognized. Thus the hand is still immobilized for fracture of the scaphoid with the thumb abducted in the plane of the palm, instead of at right angles to it. In this faulty position the patient cannot oppose the thumb and fingers, and the use of the hand is seriously curtailed. The foot is immobilized in slight equinovarus instead of in the plantigrade position, so that there is great difficulty in walking. The advantages of encouraging activity of

the limb are that rehabilitation can proceed hand in hand with bone repair, and the harmful effects of splintage are minimized. It is no longer necessary to apply an Unna's paste bandage after removal of a plaster for fracture of the tibia and fibula. Postplaster swelling has disappeared from the practice of those who make their patients walk normally while wearing a plaster cast.

Mr. Perkins laid down the rule that all joints not immobilized by splintage should be moved actively by the patient. The splint should be shortened to the minimum, so as to free as many joints as possible. Longitudinal compression of the bone ends was the essential stimulus for bone (as opposed to fibrous tissue) repair. Hence the value of early weight bearing. Most surgeons would advocate it but for fear of overriding of the fragments, but Mr. Perkin's experience was that little is to be feared. He grants, however, that there is a danger in transverse fracture when the two fragments are not parallel, for a force not perpendicular to the line of fracture tends to angulate the fragments, distracting the raw bony surfaces from one another and stimulating the production of fibrous tissue.

Mr. Perkins holds that the main reason why a healthy joint stiffens as a result of splintage is that the muscles lose their power of lengthening. This can be prevented by making them contract and relax periodically throughout the period of immobilization. They need not be stretched to the full extent. In a fractured scaphoid the wrist can be immobilized for months without becoming stiff if the patient uses his fingers. A muscle under a splint will continue to act in a synergic capacity provided one of the joints over which it spans is free to move. If in fracture of the shaft of the femur both knee and hip are immobilized—as they must be if the splint is to keep the fractured ends from moving—the thigh muscles cannot act synergically because both origins and insertions are fixed. The consequence is a stiff knee. But if the hip is not splinted and the patient is encouraged to lift his leg (he need not bend the knee) the synergic action of the thigh muscles is retained and the knee does not stiffen.

Physical Medicine in the Prevention and Treatment of Athletic Injuries. Herman J. Bearzy.

J. A. M. A. 135:613 (Nov. 8) 1947.

The immediate treatment of all sprains is focused on the control of hemorrhage and the extravasation of fluid into the tissues. Early applications of cold compresses to the rested joint will cause a constriction of the torn vessels and thus decrease the hemorrhage and transudate. A pressure bandage or dressing should follow the cold therapy, and the injured part should be put to rest in an elevated position for at least twenty-four to forty-eight hours. Once the extravasation has ceased, heat should now be applied.

A satisfactory method of applying heat to the sprain, if the anatomic position of the injury will allow, and if a fracture is not present, is the use of the whirlpool bath. Two or three thirty minute treatments should be given daily with the temperature of the bath ranging between 105 and 110 F. After several days of forced rest, passive and active assistive exercises are instituted. It is axiomatic that "once a sprain, always a sprain," so that the joint will need a supportive bandage whenever used for any vigorous exercises.

For strains, rest elevation of the part if possible, cold packs and compression bandages should be instituted to control hemorrhage and minimize the size of the hematoma. Radiant heat or hydrotherapy can be used for superficial muscle strains, but for the deep lying muscles short wave diathermy has proved the most effective method of producing hematoma absorption.

The general principles of treatment for all contusions are those of sprains and strains. Massage must be avoided over the contused area for several days, but light stroking movements should be given to the surrounding tissues. Heavy massage must be avoided over the deeper muscle contusions for fear of producing myositis ossificans.

In view of the damage to soft tissue, the measures of physical therapy applied in the "after-treatment" of fractures should be applied long before the splints are permanently removed and many days before good union of bony parts is obtained. After reduction, the fracture should be placed in a plaster cast which should be bivalved so that heat and light massage may be given in the region of the fracture without disturbing the position of the reduced fragments.

The treatment of dislocations is similar to that of sprains. All movements which tend to cause redislocations should be avoided for at least three to four months. Heavy resistance exercises should be continued for six to twelve months so as to hypertrophy and strengthen the supporting muscles and thus prevent redislocations.

Common Shoulder Injuries. Harrison L. McLaughlin.

Am. J. Surg. 74:282 (Oct.) 1947.

Common shoulder injuries are simple problems when treated by a program founded upon a knowledge of the normal functional anatomy of the part. However, the therapeutic program must be tempered by a clinical philosophy which includes comprehension and acceptance of certain proven truths pertaining to the shoulder mechanism: The only useful function served by complete immobilization or partial restriction of function of the injured adult shoulder include: (1) local rest of recently damaged tissues, (2) protection against additional damage and (3) maintenance of bone to bone apposition when aiming for scapulohumeral arthodesis in the position of maximum function.

The inevitable harmful function served by immobilization or restriction of function is the production of a rapidly progressive muscular imbalance, atrophy, stiffness of the joints and prolonged pain and disability.

Improper treatment often imposes a more severe penalty upon the patient than would a complete absence of treatment.

Considerable derangement of any single motor skeletal component of the shoulder is possible without significant interference with total function.

The most important single factor predisposing to unsatisfactory results in common injuries of the shoulder is the utilization of therapy based upon the anatomical or x-ray characteristics of the injury to the exclusion of all other factors. The presence or absence of normal anatomy, while desirable, is not especially important to the proper functioning of the shoulder mechanism.

Aspirin, codeine, gentle local heat, sedative massage and other soothing measures available are useful to control pain and spasm, especially during the first week following injury. It should be explained to the patient that any restricting dressing applied is for support, protection and comfort and not designed to immobilize the arm; and that the resultant restriction of motion is a necessary disadvantage of the early stages of therapy which must be compensated for by added effort on his part as soon as diminishing symptoms permit gradual progressive resumption of motion.

Active, gravity-free motion is possible and should be started within a few days or as soon as pain permits. Pain is the accurate measure of safety in evaluating the degree of activity to be permitted at any stage.

Within two weeks symptoms usually subside sufficiently to make pendulum exercises free and fairly comfortable. Gradual progressive resumption of aided active elevation against gravity then should be instituted. This may be done by teaching the patient how to crawl up the wall, and to throw a rope over a door, a shower rod or a pulley and carry out gibbett exercises. Coincident with subsidence of pain and the progressive recovery of function every effort should be directed toward resumption of normal use of the extremity within pain limits. Normal use which calls for synchronized action of the shoulder muscles is much more efficient than any prescribed exercise and should always be started at the earliest possible moment and gradually but progressiveiy increased in scope. As soon as the symptoms permit the sling and swathe should be discarded for progressively increasing periods and then left off altogether except when needed for protection against external forces and when he is asleep. The absence of pain and the recovery of function indicates the time when full normal activities are permissible.

Discussion on the Treatment and Prognosis of Traumatic Paraplegia. L. Guttmann.

Proc. Roy. Soc. Med. 40:219 (March) 1947.

Physical therapy for paraplegics, to be effective for restoring the man's fitness to the highest possible degree for independence, working capacity and family life, must be applied early and practiced persistently. The aims of physical therapy can be divided into two main groups:

Prevention of contractures and atrophy and treatment of the various forms of spasms. The methods employed include keeping the limbs in the correct position, passive movements, bath therapy, and surgical procedures.

Adaptation therapy of normal parts of the body by compensatory training. Exercises of normal parts of the body are carried out with a view to readjustment of the vasomotor control to postural changes and to the over-development of those muscles which are essential for the patient's upright position, as well as those which have a synergic function in relation to the paralyzed muscles and can compensate for their loss. Details of the technic of compensatory training, in which sling and spring exercises, dressing, balancing, walking exercises and games, adapted to the paraplegic's limited abilities, have proved invaluable, have been published elsewhere.

Along with physical readjustment goes rehabilitation by work. This is started with occupational therapy in the form of simple handicrafts, whilst the patients are confined to bed because of sores and urinary infection. This therapy is not merely occupation as a diversional measure, it is invaluable for the development of the dexterity of the fingers and arms, on which the future vocation of a paraplegic will depend.

Physical Medicine in the Treatment of Arthritis. Harry Kessler.

New York State J. Med. 47:1244 (June 1) 1947.

Although many classifications of arthritis are to be found in the literature, the simple division of rheumatic diseases into three groups as generally accepted and as described by Kovács is considered adequate from the standpoint of pathology and treatment: Rheumatic fever, in which physical therapy as such plays little role. Chronic joint changes: a, osteoarthritis or hypertrophic arthritis; b, rheumatoid arthritis or atrophic arthritis; and c, special forms of arthritis, including gouty, gonorrheal, traumatic, and tuberculous forms. Nonarticular rheumatism, including myalgia, fibrositis, bursitis, and certain forms of neuritis.

For the more superficial method of applying local heat, it is felt that experience has demonstrated the superior value of the luminous type of heat generator.

Histamine and mecholyl ion transfer have been used and widely acclaimed.

The contrast bath has also been found of value and frequently will accomplish more satisfactory results than heat alone. The technic as practiced at the Mayo clinic advocates a ten minute immersion in hot water at a temperature of 104 F. to 110 F. followed by a one to two minute immersion in cold water at a temperature of 60 F. to 65 F., then a repeated cycle of four minutes in hot water and one to two minutes in cold water, continuing for twenty to thirty minutes and ending with the immersion in hot water.

For the production of heat in the deeper tissues the high frequency electromagnetic induction field is effective.

The application of massage in the treatment of arthritis poses a delicate problem. Unless the

definite indications of this form of therapy are clearly understood, and unless its method of administration is carefully studied, more harm than good may accompany its employment in the more acute joints and in tuberculous arthritis, massage should be scrupulously avoided. In the subacute forms of arthritis, the administration of massage should be directed to the areas above and below the involved joint rather than over the joint itself.

An attempt should be made, provided it is not accompanied by too much pain, gently to move the joint through its full range of motion once or twice daily.

The use of ultraviolet irradiation has a definite place in the therapy of tuberculous arthritis. Ultraviolet irradiation may also be used for its general tonic effect in many chronic arthritics, particularly following long sieges of debilitating illness.

External Rotation of the Leg in Poliomyelitis. Samuel C. Yachnin.

J. Bone & Joint Surg. **29**:415 (April) 1947.

The deformity described is more accurately termed external-rotation deformity of the leg than external torsion of the tibia. Clinical examination will demonstrate that the entire tibia and fibula are rotated outward and that the tibial tubercle is definitely displaced laterally in relation to the patella. The rotation takes place through the knee joint, around the axis of the attachment of the anterior cruciate ligament on the superior surface of the tibia. When the supporting muscles around the knee are severely weakened or paralyzed, laxity of the tibial collateral ligament results. This reduces its action as a check rein to increased external rotation. The deformity occurs during the early months of the illness, while the patient is still confined to bed. The internal rotators of the hip are severely weakened or paralyzed, thus allowing the unsupported lower extremity to assume the position of external rotation from the hip downward. When this abnormal position is not prevented by whatever mechanical means are at hand, and strict attention is not paid to continued support, this deformity will probably occur.

Treatment of Coronary Artery Disease. O. P. J. Falk.

J. A. M. A. **134**:491 (June 7) 1947.

Arbitrary standardization of the time essential for complete rest in bed and avoidance of all physical activity after myocardial infarction is manifestly impossible. Acute coronary insufficiency frequently requires only a week or ten days of rest in bed, provided no area of actual infarction develops, which can be determined by the clinical course, sedimentation rate and electrocardiographic findings. Moderate degrees of myocardial infarction may only require three weeks of rest in bed, but the severer types require a minimum of from four to six weeks. Frequently the beneficial effects of rest in bed are offset by visitors, the intrusion of personal responsibilities or business worries, all of which should be shut off entirely from the patient's immediate horizon during his period of convalescence.

After recovery the most important phase in the restoration of reasonable functional capacity is adaptation to a lowered plane of activity, the development of a more philosophic outlook on life and the transition to a more tranquil and quiet existence. A degree of personal interest and patient guidance, tinctured with an understanding optimism is of greater benefit to a coronary convalescent than any program of medication, which on the whole is essentially protective in its objective.

Early Postoperative Ambulation. Edwin A. Balcer.

Am. J. Surg. **74**:472 (Oct.) 1947.

The most important advantages are decreased pulmonary and circulatory complications which result mainly from basal atelectasis and peripheral venous stasis. Clinically, this fact is supported by lower postoperative temperatures, an earlier return to normal and a lower pulse rate as compared with the strictly confined bed patients. Physiologically, it has been shown by Leithauser that the vital capacity in early ambulatory patients returns to normal in approximately one-half the time required for bed patients, while McMichael and McGibbon have demonstrated that recumbency decreases the total volume of air in the fully expanded lungs as well as the functional residual air. The studies of Smith and Allen revealed that exercise decreases the circulation time in the extremities.

Other advantages include reduced frequency of abdominal distention, absence of asthenia, shortened hospital duration and early restoration to normal activity. Having the patient attend to his personal hygiene and lessening his hospital stay are of great importance psychologically and economically, to the patient as well as to the community having limited hospital beds, nursing personnel or in a time of emergency.

The Present Concept of Treatment of Poliomyelitis. Earl C. Elkins, and K. G. Wakim.

J. Iowa M. Soc. **37**:356 (Aug.) 1947.

For the past thirty years the main feature in the treatment of poliomyelitis has been considered to be the re-education and training of weak and paralyzed muscles. The re-education varied from that used at present mainly in that it was not done as extensively and greater attention was given to prevention of fatigue. If the experimental studies on denervated muscles are correct the great emphasis placed on the prevention of muscular fatigue after the acute stage of the disease may not be the important element. The clinical results tend to indicate that prolonged immobilization was not rational. Likewise stretching the muscles in the early stages of the disease apparently is not as dangerous as was believed al-

though strenuous stretching of contracted muscles of old poliomyelitic patients may be dangerous. The use of hydrotherapy in the form of therapeutic pools still remains an important adjunct in the treatment of poliomyelitis when properly supervised.

It was emphasized that in the care of bulbar poliomyelitis, the crucial problem is the prevention of anoxia, the susceptibility of brain tissue to anoxia being common knowledge.

There seems to be a general consensus that the use of hot packs does relieve the pain and discomfort of acute poliomyelitis.

It has been fairly well established that passive stretching exercise, preferably done following whatever thermotherapy is given, is important. Whereas stretching of tight muscles was not generally considered part of the treatment in the early stages of the disease a few years ago, it is now used in varying degrees by nearly all workers. Passive stretching exercise must be done carefully, but it can be used from the early stage of the disease. As the pain subsides it can be continued until the muscle tends to remain supple and full length. After the painful stage of the disease has passed, careful stretching of the muscles apparently can be done rather strenuously without danger of injury.

The Physical Treatment of Mental Illness. Arthur Pool.

Brit. J. Phys. Med. 10:106 (July-Aug.) 1947.

The only method of physical therapy used in the early days of the retreat was the warm sedative bath.

Hydrotherapeutic methods have developed during the intervening years, and they are still effectively used in the treatment of nervous and mental illness. Colonic lavage and the continuous bath are the main hydrotherapeutic measures, the former invaluable in toxic psychoses associated with intestinal stasis and constipation, the latter one of the most soothing measures for the acute agitation and restlessness of melancholia and mania.

The continuous bath is a bath, larger than the usual household bath, with an inflow controlled by a mixing apparatus so that the hot and cold supply are mixed to achieve an adequate temperature (usually 100 to 104 F.) and the effluent pipe so regulated that the water level can be kept fairly constant. Some patients take to the continuous bath "like a duck to water," and for these it will soon prove a sedative measure. Others object to it from the onset, and any attempt at coercion will only defeat the object of allaying restlessness and agitation.

Modern occupational therapy provides the main background to the daily life of the hospital.

One of the most important pieces of apparatus from the standpoint of physiotherapy is the inductotherm. This apparatus, working on the principle of short-wave alternating current, serves a multitude of purposes.

Hyperpyrexia as an Adjunct to Chemotherapy. Chas. Ferguson, and Maurice Buchholtz.

Mil. Surgeon 101:201 (July) 1947.

Of 750 cases of uncomplicated previously treated gonorrheal urethritis treated with penicillin (80,000 to 100,000 units) prior to fever therapy of seven hours of 106 F., 94 per cent were cured (692 of 750). Of those receiving combined therapy treatment, 100 per cent were cured (150 of 150 cases); 12 patients suffering with acute cystitis, chiefly of B-coli etiology, responded promptly to combined hyperpyrexia and penicillin.

This Much Is Known About Early Ambulation. N. O. Calloway; R. W. Keeton; W. H. Cole; N. Glickman; J. Dyniewicz, and D. Howes.

Hospitals 21:48 (July) 1947.

The exercise did not replace a good balanced diet or good nursing care, of course, but it benefited the patient in measurable ways. With the hospitals of today overcrowded, and with hospital bed space at a premium, anything that shortens convalescence is valuable as a general aid in therapy. Thus ambulation promises to have important economic as well as therapeutic value. Ambulation makes possible the more rapid turnover of hospital beds by shortening the appendectomy stay from two weeks to a few days, the herniorrhaphy from two or three weeks to one week. The patient requires less care, is able to care for himself sooner and is on his way back to work earlier.

The ultimate objective is to get the patient back to work and back to his social and economic position as soon as possible. The mere discharge of the patient from the hospital does not do this. What can be done to shorten the post-hospital invalidism of the patient?

Nothing of this period is known at the present time except that it is often prolonged. It has definite psychiatric aspects and it is probably present even in mild transient infections such as a common cold.

For the occupational therapist the future of ambulation is bright. An attempt is being made to study a few fundamental characteristics and principles of exercise as a therapeutic device and as a physiologic stimulant.

It is possible to envision a time when the civilian patient will receive care in the hospital and after leaving the hospital from a group of people whose function will be to return the patients to functional maximum with the greatest possible speed. Many steps already have been taken in this direction. Already the term orthogasia has been given to this field. It means conditioning for normal function. Thus we see that a common, inexpensive, easily attained therapeutic device, exercise, definitely has taken its place in modern treatment.

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The letters used to explain in which department the matter indexed appears are as follows: "E," Editorial; "C," Correspondence; "ab," abstracts; the star (*) indicates an original article in the ARCHIVES.

This is a subject index and one should, therefore, look for the subject word, with the following exceptions: "Book Reviews" and "Deaths," are indexed under these titles at the end of the letters "B" and "D." The name of the author, in brackets, follows the subject entry.

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